Pit and Quarry

Published Every Other Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

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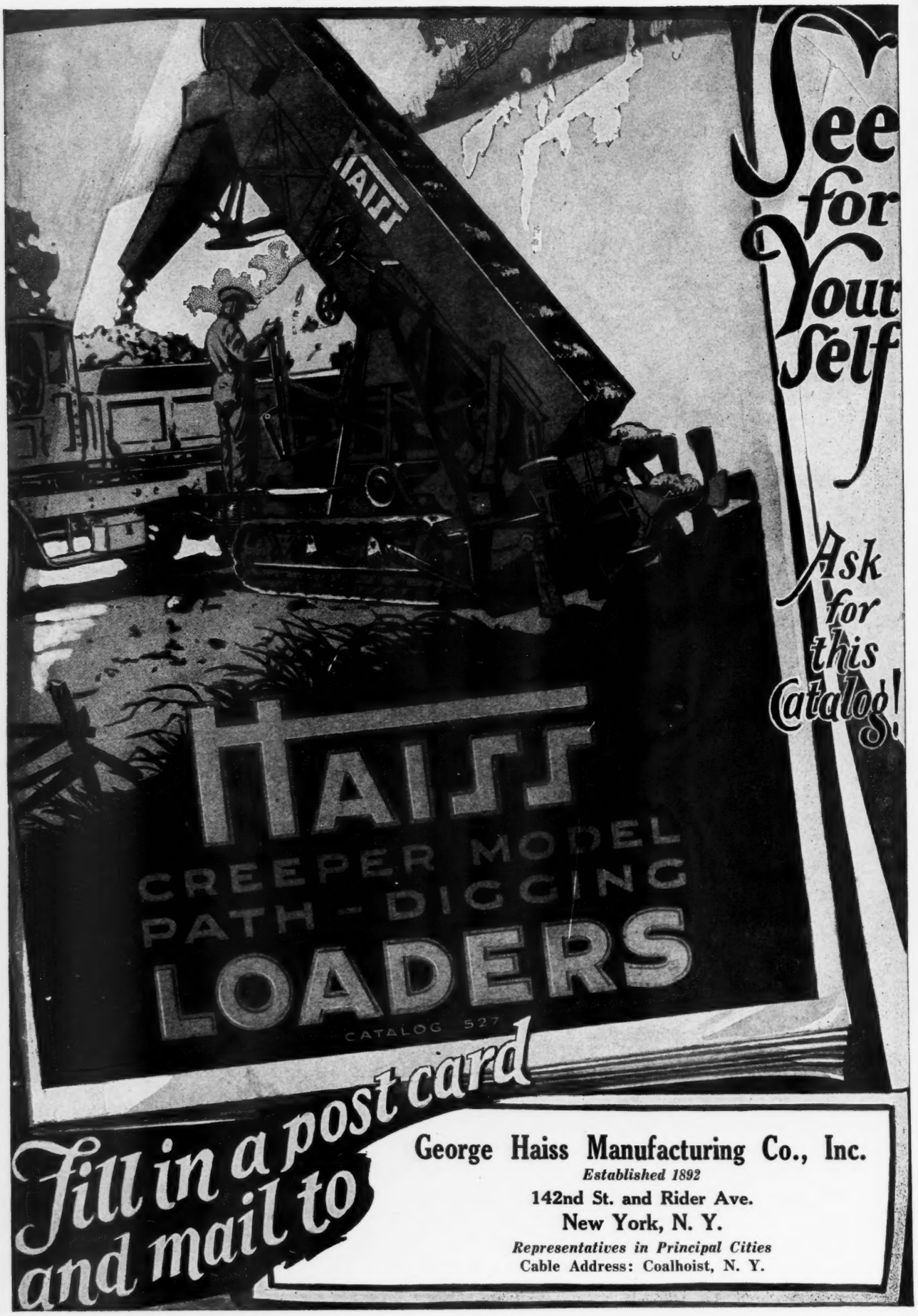
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WHAT ABOUT YOUR LABOR WASTE?

WASTE of any kind in industry is a vital problem to the executive. To cut down waste is his constant aim. Every investigation of labor turnover reveals points of waste. The expense of hiring, of adjusting the worker to his job, and of training him in efficiency must be repeated with each new man. Accident occurrence is twice as frequent during the first months of employment. Waste from the lost speed and from poor work is greater with new men. New employees require more supervision than seasoned laborers and hence bring a higher overhead. Every employee who leaves takes with him something of value in the way of knowledge of special skill which is the result of valuable training. Such losses cut in on profit. A scientific investigation will determine exactly what the loss is in dollars.

This waste of labor turnover is often overlooked in organizations in which there is little standardization. A badly managed plant is not greatly disturbed by labor turnover. In such a plant there is often so great a variety of wastes that this one is scarcely noticed. In plants where there is a good system of training and well planned methods of production there is greater cost involved in change of workmen. When efficiency prevails, the cost of labor turnover increases in direct proportion with that efficiency and is taken into account with other costs that must be controlled. The employee in a well managed plant has increased his time in training and therefore takes away more than the employee in a poorly managed plant.

Numerous methods have been tried at different times to reduce turnover, but unless these efforts have been based on sound principles of scientific management, they have been doomed to failure. Amusements such as movies, sports, etc., have been used; petting and coaxing have been resorted to; and appeals to loyalty and high principles of ethics have had a temporary effect. These experiments are all tried out for one purpose and that purpose is a good one. Every executive knows that he must build up a good morale, a plant loyalty, a spirit of team work, if his organization is to function efficiently. In the old days a notion prevailed that it required some sort of mysterious gift to secure this spirit of loyalty, but that theory has been exploded. That seemingly intangible thing called morale has been analyzed; its elements have been classified; and methods of creating it have been determined.

The first requisite of good team work in a plant is a permanent group. There cannot be a sound feeling of mutual service, of obligation, or of loyalty in a constantly changing personnel. Statistics show that labor turnover ranges from 100 to 200 per cent annually. In other words, more persons are hired in each industry during the year than are working at any one time. It is worth while for any executive to determine what per cent indicates the relation of the number of employees hired annually to his average permanent force. The rate of turnover is considered a fairly accurate standard of business efficiency. When labor turnover reaches 200 per cent annually, the waste is equivalent to that resulting from a strike. The disorder is spread over the entire year, but the loss, if estimated, would undoubtedly equal that of a strike of several weeks' duration. It is with a permanent group that plant loyalty can be maintained.

The best way to reduce turnover is to operate under efficient management. There is no desire on the part of most employees to have high turnover. Their best interests lead them to prefer permanent jobs. Hence the causes of turnover should be determined and dealt with scientifically. If it is found that a large percentage of turnover is caused by dissatisfaction with wages, it is an indication that the wages paid are below the market rate and that the employees who are retained are too inefficient to command the market rate. Scientific management cannot prevail with a uniformly inferior group of workmen. Therefore a study of the wage situation will be a part of a program of economy.

If sickness is a cause of high turnover, it is possible that some simple changes in working conditions may take care of the situation. If there are many cases of employees' being discharged because they are incompetent or insubordinate, it is advisable that the chief executive give consideration to his minor executives. A mistake in the placing of a foreman may bring an unnecessary and expensive turnover, while a shift of places may result in more satisfactory conditions for all concerned. While there are conspicuous exceptions to the rule, it is safe to assume that every man in the organization from the highest subordinate to the most ignorant workman prefers to be successful in whatever he

is doing. It is the responsibility of the executive to have his men so placed that they are of the greatest value to him. This occurs when they are placed where they work with most satisfaction to themselves. Hence all supervision and discipline should be of such nature as to build up plant loyalty.

A sure method of reducing turnover is to create a pride in the product. Interest in the work comes with knowledge of the results of the work. Employers who keep their employees informed as to the importance and good quality of the product which they are producing are well repaid for their efforts. Executives who spend lavishly in order to build up good will in the market will be wise if they also give some thought to advertising the product among the workmen. An employee likes to boast of the firm for which he works; he enjoys being enthusiastic about its standing among other members of the industry. He has a personal pride in up-to-date equipment; he gets great satisfaction out of a new and powerful machine. The installation of a new piece of equipment which is the latest model is a matter of personal satisfaction to the men who are to operate it. It means to them that their product will be second to none on the market. Their pride in that product will be measured in the profits of the business at the end of a year. They will not be quick to leave a plant that they think of with pride.

A permanent group producing a commodity in which they are interested will build up traditions. No factor will be more effective in reducing turnover than solidarity based on traditions. A group of workmen during a noon hour entertaining themselves with the immortal, "Do you remember when" stories, will be held together by their pride in the past. There was the time when a production record was broken, when an accident was averted by someone's thoughtfulness, when an unusual occurrence resulted from a blast. There are also humorous things to be remembered and talked over. Traditions weld the group together and keep them on the job. All are factors in eliminating the waste of turnover which is an unnecessary waste. And all reduction of waste proves its worth when the financial reckoning comes at the end of a year.

AN IMPROVED ATTITUDE

A FINE spirit of mutual helpfulness among producers seems to be displacing the old attitude of selfish, suspicious, aloofness. The theory that is ensuring wide-spread success is that wholesome competition is beneficial and indicative of general prosperity, that competition and cooperation are compatible, each stimulating the other; and that such cooperation has a sound economic foundation.

The producer who is operating on the principle of the old "Keep Out" sign is losing more than he gains. He is barring the other fellow from beneficial cooperation, and at the same time he is depriving himself of advantages. The chances are that he has nothing of value to hide and that his "Keep Out" attitude is sheer bravado.

The producers who are changing that sign to the cordial and up-to-date slogan, "Come In," are the ones who have something worth while to give. They will not only benefit themselves but will aid the entire industry. The value of an exchange of ideas with a competitor far exceeds any value derived from a policy of reserve.

As far as the product is concerned, each one will make the best one possible. That is the key to his success. He has no cause to fear competition. He needs competition to stimulate the industry and to enliven the market. Business is the greatest field of human activity. Competition is the impelling force which ensures the preservation of individual initiative. Fair competition enables the producer to realize success through efficiency and not by artificial factors.

We can have cooperative organization of industry without injuring competition. Preservation of the competitive system depends upon the ability of business men to solve their problems through collective action. Hence, competition and cooperation are being put on a sound scientific basis through trade associations. When we find producers coming together from all sections of the country for the purpose of studying conditions, comparing results, and exchanging ideas for their mutual benefit, we can foresee untold possibilities for future development. When two rival producers, deadly foes in the business game, meet for a battle on the golf course and later come together at the convention banquet, there is sure to follow a solution of some of the problems with which they are both concerned. These two rivals go back home, once more enemies in the production game, but the enmity bears no bitterness and they have contributed their part in the general broadcasting of the spirit of scientific cooperation which is increasing with every such meeting. Trade associations thus strengthen business ideals, lessen the wasteful frictions of trade, solve the knotty problem of production and distribution, and are a potent element of economy.

There are many wastes in our system of competition which may be lessened through the work of trade associations. Unnecessary plant duplication results in a producing capacity in excess of demand. This may be regulated through a better understanding of the situation.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

George T. Cameron

Mr. Cameron is President
of the Santa Cruz Portland Cement Company
of San Francisco, California

MRS. GRACE M. EVANS SHOWS THEM AND HOW TO RUN A CRUSHED STONE PLANT

FOR several years the Monon Crushed Stone Company has been operating a bed of Niagara blue limestone that is practically inexhaustible. The crushing plant and quarry are located about one mile south of Monon, Indiana, on the Cincinnati, Indianapolis and Louisville Railroad. The plant and quarry, together with unworked acreage, occupy a tract of 20 acres, but Mrs. Grace M. Evans, who owns and operates the business, has a farm of 100 acres adjoining, and the entire tract is underlain by a strata of this valuable stone. It is more than 260 feet deep and is of uniform quality. The total depth is not known, but one deep test well was sunk near the crusher house to a depth of 265 feet and it was still in this stone.

It is hard and flintlike, with good wearing qualities. It not only makes an excellent material for road building, either macadam or concrete, but it also is extensively used for fine aggregate in concrete work, for agricultural limestone and for railroad ballast.

The chemical analysis is as follows:

Insoluble matter	.25
Silica	.08
Oxides of iron and alumina	.14
Carbonate of lime	56.28
Carbonate of magnesia	43.26

These results show that the stone consists almost entirely of carbonate of lime and carbonate of magnesia.

The company was established March 24, 1909 by the late Herman H. Evans of Lafayette, Indiana. It was opened as a piece work, hand operated quarry, with one small crusher, the first opening being made at a point a few yards east of the present crusher house where the stone outcropped. The first output was used for macadam roads in the vicinity of Monon. Small dump cars were filled by hand, then hauled by mules to the foot of the incline track where they were pulled up by a steam hoist. As the business progressed the mules and hand loading were replaced with dinkey engines and a steam shovel. As the business expanded from year to year additional hauling and loading equipment was added until it has grown from an out-

From Left to Right: Mrs. Evans, George Balfe, Gen. Mgr., W. B. Newman Sales Mgr., C. D. Gavin, Accountant and J. C. McGuire, Gen. Supt.

General View of Property Looking West

Loading Cars In Quarry

put of two carloads a day to an average daily output of 2,000 tons.

Mr. Evans died March 12, 1918, during the world war and this quarry, along with others, not being considered an essential industry by the government, was closed from October, 1917 until April, 1919. As soon as the government ban was lifted, Mrs. Evans took hold of her husband's business and has carried it on since that time, with the efficient assistance of George H. Balfe, general manager, and a quarryman of wide experience. She has ably shown her executive ability evidenced by the growth of the business under her ownership. Her office is in a small building a hundred yards south of the crusher house where she can be found six days a week. Here she has a small kitchen and dining room and has lunch prepared for herself and the office force. John C. McGuire is general superintendent, William B. Newman sales manager and Charles D. Gavin accountant and shipping clerk.

Mrs. Evans, besides being active in the management of her crushed stone business, has other interests. She runs her farm of 100 acres adjoining, and has made it show a consistent profit. She is active in the affairs of the National Crushed Stone Association, and at the annual convention held last February at West Baden, Indiana, she was official hostess for the ladies and arranged for their entertainment. It is only on Sundays and holidays that she may be found in her home at Lafayette, for on the other days she's on the job.

The plant is housed in a frame building alongside the main line of the C. I. & L. Railroad. Shipping facilities are provided by two lines of this railroad which intersect at Monon, one running from Indianapolis to Chicago, and the other running south from Michigan City through Lafayette, Crawfordsville, Greencastle, Bloomington, Bedford and other Indiana cities, to Louisville, Kentucky.

The maximum capacity of the plant is 60 cars a day, with an average production of 35 to 40 cars. A total of 61 men are employed during about nine months of each year. During freezing weather, which is about three months of the year in this section, no attempt is made to operate because the material would freeze to the cars and clog the crushing machinery, elevators and screens.

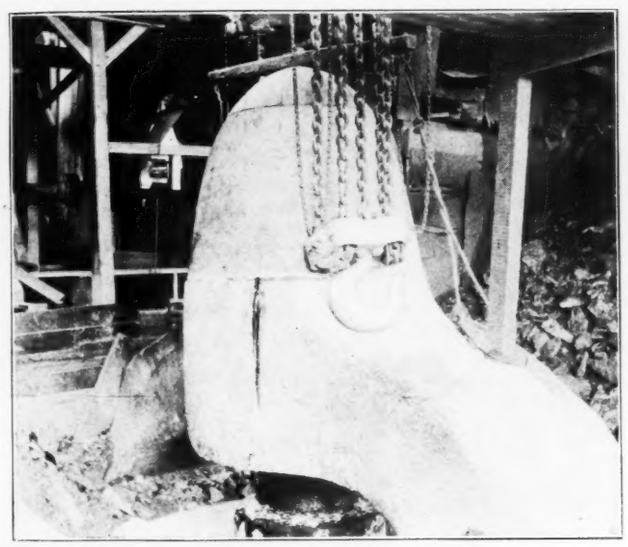
In the main, steam power is used, although the machinery is being gradually equipped with electric motors. Already the pumps, drills and smaller machinery are operated by electricity. Power is

General View of Quarry Looking East

furnished by a 500 h.p. Corliss steam engine, operating a 16 foot flywheel, driven by a two ply leather belt, 36 inches wide. It runs 90 r.p.m., drives off of a main shaft, and power is delivered to various parts of the crusher house from this main shaft. Steam is furnished by three 150 h.p. boilers made by the Bass Machine and Foundry Company. The boilers are hand fired with West Virginia coal.

Two air compressors furnish compressed air for the three jack hammer drills. One of these is a Westinghouse, direct driven by steam with a 9½ by 10 inch cylinder. The other is a Union Steam Company pump with a 10 by 10 inch cylinder, driven by a 40 h.p. General Electric motor, 220 volt, 900 r.p.m, and it pumps about 250 cubic feet of free air per minute.

The overburden consists of light sandy soil, easily handled, and it ranges from a few inches up to about four feet thick. It is removed by electric



Close-Up of the No. 18 Crusher

and steam shovels and hauled to a dump pile near the quarry. Four drills are used; two Loomis and two Sanderson Cyclones, operated by electric motor and with electric driven traction. Six inch holes are drilled, 55 feet deep. These drills operate at the rate of about six feet an hour. About 150 pounds of dynamite is used in each hole. No special brand is favored, Hercules, Grasselli and Du-Pont having been used in about equal amounts, with uniformly satisfactory results. They aim to have as many holes as possible ready for each shot, but there is no fixed number. They have shot as many as 150 and as few as 10 holes at one time.

Only one bench had been worked previous to the spring of 1928, when another was started. This is the same depth as the first one, about 60 feet, and the quality of the stone is identical throughout. Both benches are being operated now, and this will continue indefinitely.

For secondary shooting, such as breaking up the larger pieces of stone and for hog back shots, three

Crushing and Screening Plant

jack hammer drills are used, operated by compressed air. One of these is an Ingersoll Rand, one is a Hardscoe Wonder, and one is a Gardner Denver make.

Marion shovels are used to load the steel dump cars in the quarry. One of these, the latest addition, is a number 37 electrically operated, on caterpillar truck, Ward Leonard equipped, with a two-yard dipper. Two Marion steam shovels mounted on caterpillar trucks have given good service. One of these is a number 36 and the other is a number 50, both equipped with a 1¾-yard dipper. American Steel and Wire cables are used on all these shovels.

For moving material in the storage yard, which

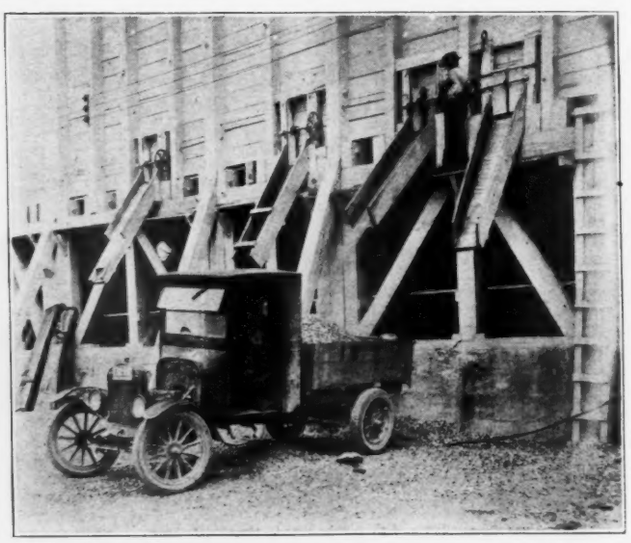
Close-Up of one of the Drills

Front View of Plant

extends along part of the west and the entire south side of the quarry, a 20 ton Browning crane, operated by steam and mounted on a railroad truck, is used. It is equipped with a 1½-yard Joseph F. Kiesler bucket. American Steel and Wire cables are used.

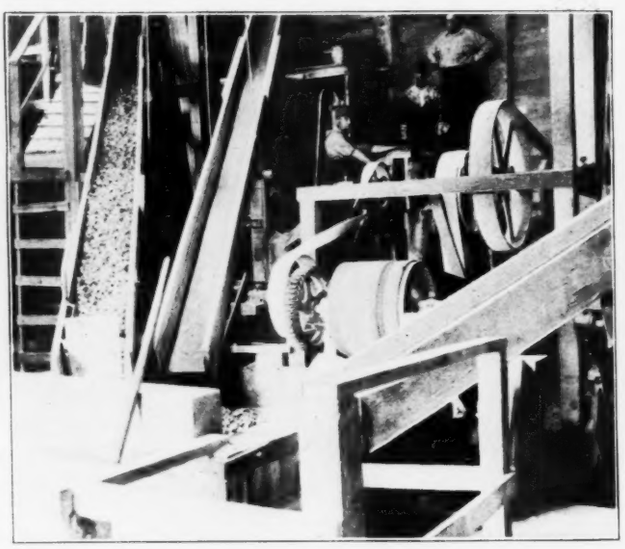
Motive power for hauling the steel dump cars in the quarry is provided by four dinkey steam locomotives on a 36 inch gauge track. One of these is a Davenport 13 ton with 9 by 14 inch cylinders, two are H. K. Porter 13 ton with 9 by 14 inch cylinders and one is a Baldwin 13 ton with 9 by 14 inch cylinders. Fifty-two two-yard Austin special end dump steel cars carry the stone from quarry to crusher.

The stone after being loaded and hauled to the incline, is pulled up the track with two special geared Allis Chalmers hoists, and dumped into a No. 18 Allis Chalmers crusher. Two tracks are used, feeding into opposite sides of the crusher. One track comes from the first bench and the other from the second bench of the quarry. From the large crusher the stone is carried by bucket elevator to the scalping screen. Here the various sizes are separated and carried by chutes to the elevators that lift the material to the screen house where it is sized for whatever the demand may be. Chutes also carry the tailings from the scalping screen to the auxiliary crushers, of which there are six; a number 8 Allis Chalmers, three number 3 Allis Chalmers and two number 37 A Kennedy Van Saun ball bearing crushers. The number 8 is used for the intermediate sizes and the others for regrinding and for producing ¼-inch and smaller sizes. The total crushing capacity is 300 tons an hour.



Loading Truck From Chutes

The stone is graded by four circular screens, 60 inches in diameter and 24 feet long, located in the screen house over the storage bins. Nine sizes of crushed stone are produced, ranging from five-inch to ¼-inch, besides the finer material which is caught by the screens and sold for agricultural limestone. From these screens the stone is fed by chutes direct into the bins. Two of the screens are



Chutes Leading From Scalping Screen

Allis Chalmers and the other two are Austin make. The scalping screen is an Allis Chalmers. Two shaker screens, designed and made in their own shops also are used with very good results. All screens are operated direct off of the line shaft.

Besides the open storage extending along the south side and part of the west side of the quarry, there are nine frame bins directly under the screen house with a capacity of 1,000 carloads. They are over a track where railroad cars are loaded, and side chutes lead out along the east side for trucks.

A modern machine shop and blacksmith shop housed in small frame buildings near the crusher house are equipped to do all the repair work, sharpen all bits and do all the blacksmith work.

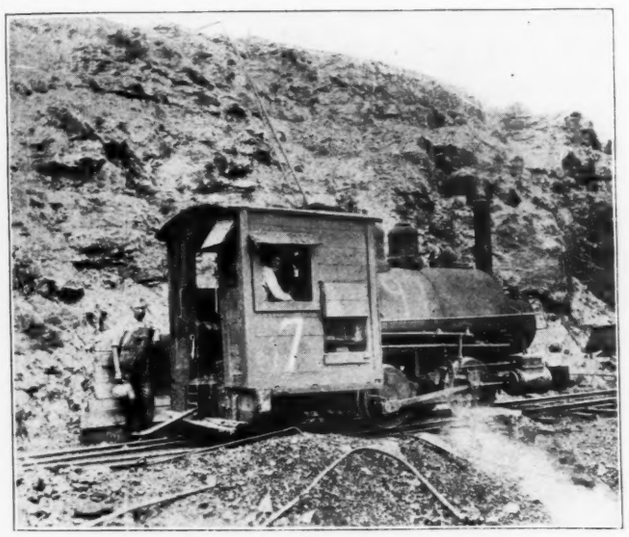
The machine shop is equipped with an 8 by 18 quick change American lathe, a 7½ h.p. 220 volt General Electric motor, a 16-inch Steptoe shaper, a 28-inch Rockford drill, a 4 by 4 inch capacity

Premier power hacksaw, a 300 ampere U. S. electric welder, an acetylene welder and cutting torch, an electric tool grinder, and enclosed drawers and cabinets for all sizes of bolts and set screws of standard makes.

The blacksmith shop is equipped with a circular forge for general blacksmith work, one 300 pound Porter Wright hand drill, an extra heavy 6 inch jaw vise, an Armstrong bit sharpener for the blast drills, a 100-pound electric driven drop hammer, a coke furnace for dressing the blast hole bits, and a full complement of general blacksmithing tools, including cutoffs, smoothers, fullers, flatters and set hammers.

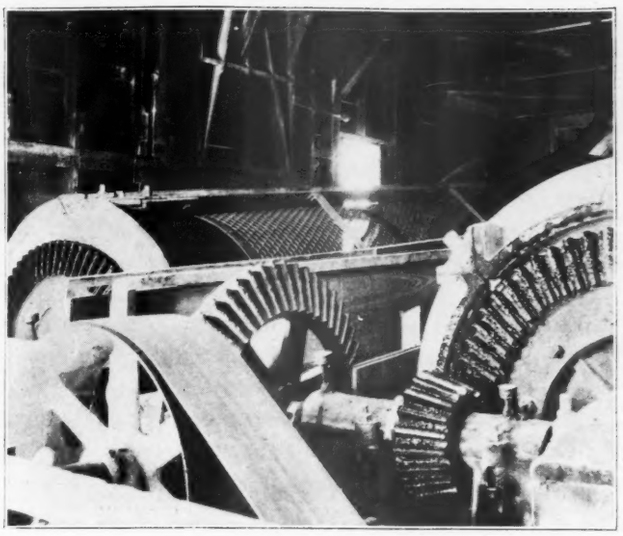
The water used in the plant is pumped from a well 257 feet deep. It contains a small amount of sulphur. From the pump it goes through a Zeolite softening plant which renders it of zero hardness. With this softening outfit, there has been no trouble with scale or lime forming in the boilers, thus greatly increasing the efficiency of the plant.

The exhaust steam used in the operation of the plant is passed through steam condensers, and soft water from the water storage tank is passed over them, making a distilled water for use in the boilers, and also adding many degrees of heat to the soft water that is used for condensing the exhaust steam. In the interchange of heat in the steam condensers and exhaust steam heaters, the temperature of the water is raised, and before being pumped into the boiler is almost steam itself—about 210 deg. Fahr.



Close-Up of One of the Locomotives

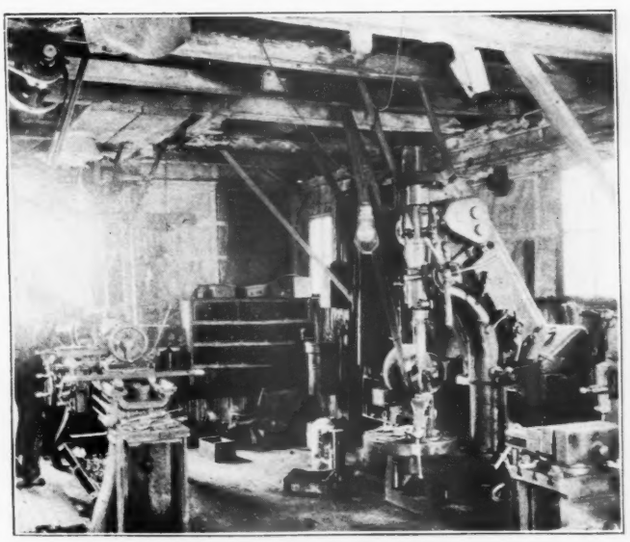
One of the pleasing qualities of the product of this plant is the fact that the stone in the quarry is clean, with no mud pockets, seams or faults. This makes it possible to produce a clean stone without washing. Most of it is used for roads; macadam, portland cement concrete and water bound concrete. A considerable amount is used in the construction of concrete buildings, and as mentioned before much of it is sold in the form of ground limestone for agricultural use.



View In Screening Plant

Agricultural limestone is an interesting by-product of this plant. About 10,000 tons are sold annually and shipped in carload lots of not less than 50 tons, most of it going to farmers in northern and central Indiana. A recent test made by the Purdue University Experimental Station shows that this limestone contains over 107 per cent of acid neutralizing power. That is, it will neutralize as much acid as if it contained 107 per cent calcium carbonate. This is as high as any ground limestone product manufactured in the state of Indiana is guaranteed to contain. Magnesium carbonate has a little higher acid neutralizing power than the same amount of calcium carbonate, and may be used to just as good advantage.

Most of the finished product is shipped by railroad, going to points in northern and central Indiana and southern Michigan. About 10 to 15 per cent goes out by truck, hauled off by contractors and other customers located nearby. The company



Interior View of Machine Shop

does not operate any trucks, all stone being sold F.O.B. the plant. All sales are made direct to the consumer, none of the company's product being sold to dealers or other middlemen. Their customers are mostly road and building contractors, and county and state road officials. Agricultural limestone is sold direct to farmers, and some stone is sold to railroads for use as ballast.

Within the last few years, railroads in this section have begun to use crushed stone instead of gravel for ballast. While the initial cost is slightly higher, it does not pack like gravel and provides better drainage. It also will last longer than gravel and thus provides a more permanent improvement.

Until recently, screenings were used only for water bound macadam and agricultural lime, but tests have been made on its use instead of sand as fine aggregate in concrete. These tests, which included crushed rock for the coarse aggregate, show a very high compression strength. Mr. Balfe, who is specially interested in this phase of the business, says that aside from this test, their experience has led them to the conclusion that concrete made from stone and screenings is better than that made from sand and gravel. As a test, all-stone concrete was used in the construction of the piers and abutments, and foundations for the crushers and other machinery in this plant, with entirely satisfactory results.

Uniformity in Electric Detonators

The importance of maintaining uniformity in the electric detonators used in mining and quarrying operations is emphasized by Dr. Charles E. Munroe, Chief Explosives Engineer of the United States Bureau of Mines, Department of Commerce. Detonation is induced and developed in blasting with high explosives by firing detonators, or electric detonators, inserted in the explosive with which the boreholes are charged. It is evident that these small initiating devices are important elements in the explosive systems used in blasting with high explosives, and that their satisfactory and dependable behavior is essential to the successful operation of the system, Dr. Munroe points out.

Although quite small, these devices, and especially the electric detonators, being each composed of several elements, are complex. Thus there is the metallic capsule; the compressed charge, which is frequently a mixture of ingredients that must be compounded and compressed with great precision; the match, which may be of a simple or of a composite nature; the legs; the bridge; the solder, or other material, joining the bridge ends to the legs; and the plug. This complexity requires that especial care and great manipulative skill be exercised in the manufacture of these devices, and that there be especially rigid and searching factory supervision and inspection, to the end that the detonators and electric detonators offered in the market may be of strictly uniform and definite character. They should also be so made that this character may be retained over a long period of time, provided the detonators and electric detonators are packed, handled, transported, stored and used in accordance with approved practice.

To use electric detonators, there are required insulated leading wires to connect the legs of the detonators with the source from which the electric current employed to fire these detonators is to be drawn, and suitable circuit breakers to prevent the electric current from flowing through the bridge of the electric detonators until the shot firer desires it to do so. Though other means for doing so have been devised, detonators are, as a rule, fired by burning fuse which is ignited in the open.

It is obvious that detonators, with their accompanying fuse, are in first cost and in use cheaper than electric detonators, with their accompanying paraphernalia. There are too many operations, such as in bulldozing scattered boulders; in occasional minor operations, as in agriculture, and in cases of emergencies, such as demolitions to bar the progress of fires, where detonators are to be preferred. Electric detonators, however, present a marked advantage over detonators in the greater assurance of safety in use that they afford. When detonators are used the fuse is ignited at the face of the blast and the safety of the shot firer depends mainly on the nimbleness and speed with which he runs to reach a place of safety, whereas, when electric detonators are used, the shot firer first places the firing machine in a safe place, loads his boreholes, attaches the detonator legs to the leading wires, returns to the firing machine, untwists and couples on the leading wires, gives the warning signal and then fires from this safe place.

It is common practice in quarrying for road material, concrete aggregate, limestone flux and the like, or in engineering operations for earth cuts and fills, or the removal of rock barriers, to arrange to fire a considerable number of charges at once. Thus in some cases twenty well-drill holes, staggered in two lines from the face of the quarry, will be driven to considerable depths from the top of the bench. These holes are so placed, and provided with such charges that when fired simultaneously each will do its assigned share of the work in bringing down the rock and breaking it up into the desired size. Operations such as these may be satisfactorily carried out by the use of electric detonators with which to initiate the explosion of the charge in each bore hole, provided the electric detonators used are of uniform character.

It will promote safety and efficiency, says Dr. Munroe, if electric detonators made by all manufacturers are not only, grade for grade, of the same efficiency, but that they conform to the same electrical standards.

ALTERNATE HARDENING OF PORTLAND CEMENTS

By Dr. Hans Kiehl, Berlin-Lichterfelde

ALTERNATE hardening of cement is understood by the writer to mean the treatment of cement so that the test samples are alternately hardened in air and under water. Thus the German Standard Methods for Testing Cement call for a combination hardening of the cement in which the test samples are allowed to remain in moist air for one day, under water for six days and for twenty-one days in air. In carrying out certain tests on cements that were stored for twenty-one days in air and then for an additional twenty-eight days in water, Gensbaur found that the water storage reduced the strength of the cement to a considerable degree. He derived a certain number of conclusions regarding the tendency of the cement to disintegrate under these conditions, but his conclusions have been often found to be contradictory and inconclusive.

The author assumes that the readers of his article are familiar with the work of Gensbaur, Keith, Haegermann, Haensel and Schweigl and hence will not review the reports that these investigators have made on this subject. He assumes as conclusive that reduction in strength occurs quite commonly under these conditions, that is when porous solids are saturated with water. He, however, believes that the conclusions that have been drawn regarding the phenomena accompanying the storage of cement under water are too involved and not justified, when the aforementioned simple fact of water absorption by the cement is taken as the basis.

The author set a fourfold task for himself in his investigations on this subject. In the first place he decided to establish the facts surrounding the variation in the strength of the samples when allowed to harden both in air and in water, so that he could draw a complete picture of the mechanism of the entire operation. In the second place he tried to establish the time at which the minimum strength of the cement samples was attained when they were hardened in air and under water. In the third place he studied the influence of the alternate hardening process on the progress of hardening, when the time of hardening was changed. In the fourth and last place he tried to derive certain conclusions both from his general knowledge of the subject and from the results of these experiments as well, which conclusions might serve as explanations of the phenomena that take place during the alternate hardening process.

The author limited his investigations to such cements that did not have a marked tendency to disintegrate, that is separate out lime. This simply means that the author selected in his first experiments cements which were able to stand up in an unobjectionable manner in the accelerated constancy of volume test and in the boiling test as well. On the other hand the author extended the field of his research beyond the limits that were set by other investigators, and hence did not limit

*A contribution from the Cement Technical Institute of the Technical High School in Berlin XXVI.

GENERAL VARIATION OF STRENGTH IN WATER STORAGE

GROUP	Cement Mark	Strength in compression. 1:3				Tensile strength. 1:3			
		3 days water	7 days water	28 days water	56 days combined	3 days water	7 days water	28 days water	56 days combined
	A	114	187	324	475	12.3	19.0	25.5	34.0
	B	384	486	492	539	32.7	35.7	36.7	40.0
1	C	358	440	472	567	27.2	29.3	33.8	35.5
	D	413	574	564	679	30.5	36.0	32.3	36.8
	E	235	291	376	416	23.3	29.5	30.2	36.6
	F	252	378	437	506	22.7	30.0	32.3	33.8
	G	250	341	484	535	24.7	29.0	32.3	39.3
2	H	219	288	339	407	23.7	23.7	29.2	30.6
	J	538	572	623	751	35.0	35.8	40.5	37.5
	K	449	477	516	634	31.5	33.0	33.8	33.7
	L	273	386	389	449	25.5	29.0	35.5	34.5
3	M	219	289	414	429	19.0	20.7	28.0	25.8
	N	379	457	458	521	25.7	30.0	33.3	34.7
	O	219	315	445	462	22.2	26.8	30.8	34.0
5	P	293	461	518	518	26.3	27.8	28.5	32.5
	Q	210	268	322	346	20.3	22.8	30.7	30.0
	R	315	399	479	514	26.0	37.0	36.3	31.5
6	S	304	407	472	497	23.5	28.3	33.8	33.3
	T	283	359	421	390	22.2	32.3	32.7	35.3
7	U	192	280	426	386	17.8	22.0	25.8	28.3
	V	277	403	496	461	26.0	24.5	30.5	38.5
8	W	275	352	508	438	22.7	27.0	33.0	36.0
	X	268	320	403	329	24.7	25.5	28.5	35.0
	Y	496	586	683	664	31.0	34.3	37.3	34.3
9	Z	317	442	567	492	28.5	30.3	37.0	35.0

his experiments to supercements alone, but also tested a number of common Portland cements.

Twenty-five Portland cements were used in the experiments. Some of these cements were purchased on the open market and some were furnished by their makers. All the cements were designated by letters of the alphabet and the results that were obtained in testing these cements are given in tabulation number 1. The cements were divided into nine different groups, as may be seen from this tabulation. The determining feature, which classified the cements in this manner was their behavior under the condition of combined or alternate storage in air and under water. Thus class 1 contains those elements which increased both in tensile and in compressive strength under these conditions.

Classes 2 and 3 contain those cements, which, while they increased in compressive strength, decreased in tensile strength. The final tensile strength of the cement was determined after more than twenty-eight days' storage under water in the case of class number 2, while in class number 3 the tensile strength was determined after less than twenty-eight days storage under water. The cements, contained in classes numbers 4 to 9, lost in compressive strength, and this took place in such a fashion that the final compressive strength in the cements of classes number 4 to 6 was attained after more than twenty-eight days storage under water, while in the case of the cements of classes number 7 to 9 the final compressive strength was attained after less than twenty-eight days storage under water. The difference between the cements of classes number 4 to 6 on the one hand and classes number 7 to 9 on the other hand lies again in the drop in the tensile strength of the cements in the same manner as described in the case of classes numbers 1 to 3.

The author tried to establish a mathematical relationship between the reduction in pressure that takes place in the combined storage of the cement in air and under water and the common strength characteristics of the cement. He must, however, say that his efforts have been without results up to the present time. In fact as one gets deeper and deeper into the mathematical side of this question, the more one gets the impression that factors are determinative for the results of the combined hardening test, which are beyond our knowledge and which cannot be determined at any rate for a system which included the materials that were tested in this particular case.

For example if in the case of class one, which behaves best as far as the combined storage test is concerned, cement, B, gives the same picture in its entire behavior as cement, Z, in the last class, which is the worst from the standpoint of the combined storage test, when common Portland cements and supercements are used interchangeably and when cements are employed in the testing which give better results in compression under the condition of combined storage in one instance and better results in tension in another instance, then it is conclusive that forces are operative here, which at any rate cannot be ascertained or established from the results given in tabulation number 1.

Gensbaur originally determined that the strength of the cement should be established after it had remained for exactly twenty-eight days under water. Nevertheless this time period was chosen with a certain freedom of selection. Thus investigators have undertaken to determine the changes in the strength characteristics of cements which have been allowed to remain for more than twenty-eight days after combined solution in water. The author has viewed this matter from a somewhat different angle. He has attempted principally to determine the progress of the strength curve during the twenty-eight days observation period, established by Gensbaur.

The author thus selected cements, E, H, N and Q, and tested them in such a fashion that the variation of the strength of the cement was observed after renewed storage in water first for small and then for greater periods of time until a maximum period of twenty-eight days was attained. The first strength tests were made after the cements had been allowed to remain under water for three hours, the second test was made after six hours, the third test after twelve hours and the following tests after one, two, three, seven, fourteen and twenty-eight days. The tabular material, which the author collected in this manner, is shown in tabulation number 2. The values for

TABULATION No. 2

Cement Mark	Storage in water 1 day	2 days	3 days	7 days	28 days	56 days	Combined storage 28 days	56 days
Strength in Tension 1:3								
E	14.0	20.8	23.3	29.5	30.2	37.8	*37.8*	*39.7*
H	14.3	19.5	23.7	23.7	29.2	33.7	*32.0*	*38.4*
N	16.3	24.7	25.7	30.0	33.3	34.3	*39.3*	*39.4*
Q	12.0	17.7	20.3	22.8	30.7	33.2	*37.5*	*39.2*
Strength in Compression 1:3								
E	132	221	235	291	376	386	*374*	*418*
H	83	173	219	288	339	409	*391*	*414*
N	190	359	379	457	458	530	*534*	*539*
Q	112	187	210	268	322	355	*350*	*376*

TABULATION No. 3

Three Day Alternate Hardening

Cement Mark	3 days water	6 days air	9 days water	12 days air	15 days water	18 days air	21 days water	27 days water	30 days water	33 days water
Strength in tension 1:3										
E	22.3	27.3	30.6	33.4	30.2	32.8	31.7	32.8	32.8	33.3
H	22.5	30.1	27.1	31.4	27.6	35.3	30.5	33.1	29.4	35.9
N	27.5	33.0	33.6	33.4	32.8	34.1	35.8	36.1	35.7	36.4
Strength in Compression 1:3										
E	241	278	282	296	330	333	330	353	348	369
H	176	252	279	299	317	320	318	369	346	368
N	354	438	466	486	449	526	516	529	528	534

combined storage are shown underlined. The results which are given in this tabulation have been plotted graphically in a number of curves.

While the individual results vary rather widely, nevertheless, it may be concluded that in general the strength of the cement samples, after they have been stored in water, decreases comparatively rapidly, and reaches the minimum after approximately three days. Then the strength begins to increase again, and it is a matter of conjecture as to how far this increase in strength will go after a period of twenty-eight days has elapsed.

The fact that the storage of the samples in water results in rapid decrease in strength and that a rapid increase in strength takes place when the samples are removed from the water and are allowed to remain in air, made it appear advisable that additional investigations be undertaken to determine if possible the path of the strength curve, when the test samples are allowed to harden first for a few days under water and then alternately for another few days in air. The author accordingly carried out two series of experiments with cements E, H and N. The cements were subjected to hardening for three days under water and then up to forty-two days in air. Another series of tests subjected the cements to seven days of hardening under water alternating with hardening in air up to fifty-six days. The strength figures, which were obtained in these experiments, are given in tabulations number 3 and 4 and the numerical results are also given in graphical form in the original article.

From the fact that the hardening curves intersect each other several times in all three cements, that is, both the curve for strength in compression and the one for strength in tension, the conclusion is derived that both the three day and the seven day alternate hardening have the same final effect. Furthermore, these curves show plainly that when the cement samples are placed under water decrease in strength is marked, while when they are allowed to remain in air the increase in strength is just as well marked. It may at any rate be concluded that storage of the cement samples under water had the effect of retarding the development of the full strength of the cement on hardening. On the other hand the storage of the cement in air accelerates the development of the strength of the cement. Hence this must be the final deduction from the experiments on the three and seven day alternate hardening.

When all the results of these experiments are considered and studied in their entirety with the object of arriving at some definite conclusion from them, all that can really be said in the way of such a conclusion is that the saturation of dry bodies with water and the drying out of these wet bodies are two processes, which are the reverse of each other from a purely physical standpoint, for one of these processes reduces the strength of the cement while the other increases it. When, however, it is seen that there are many exceptions even to this fundamental rule, then it is evident that the key to the explanation of the strength curves cannot be found in this fact. Hence we must agree with Gensbaur and look for chemical causes wherever the variations are very marked or wherever the basic rule is contradicted altogether. However, it is just in this case that great difficulties arise, and the reader will agree with the author that the results of the experiments, which have been described in this article, are not able to afford any worth-while explanation of the chemical processes which play a part within the cement during its hardening.

In fact, quite the contrary, the author has found in his work and particularly from the results of the present investigation a certain conclusion which he has often discussed in previous articles (see Zement, 1923, pages 155 and 174). This theory is that the external hardening diagram is the aver-

TABULATION No. 4

Seven Day Alternate Hardening

Cement Mark	7 days water	14 days air	21 days water	28 days air	35 days water	42 days air	49 days water	56 days air
Strength in tension 1:3								
E	27.5	30.2	30.6	27.3	33.0	40.3	32.0	42.8
H	27.8	32.6	31.3	42.0	32.1	37.4	34.0	35.1
N	28.7	33.3	33.2	41.7	34.0	37.7	32.8	34.5
Strength in compression 1:3								
E	266	325	327	353	374	379	392	389
H	255	319	314	344	340	370	372	393
N	476	468	514	529	554	588	533	569

age diagonal of the numerous individual processes and that even a great mass of experimental data is not sufficient to resolve the average line, observed by the author, into its component parts. Numerous chemical reactions between the individual ingredients of the cement and the water used to mix it overlap each other and bear quite different relationships to the physical influences of the absorption and the removal of water. Most of these forces act to increase the strength of the cement, and this fact must lead to the conclusion that, taken all in all, the strength curves of the cements follow an ascending path under very varying conditions. However, even in the best grades of cements there are always forces active, which act against the progressive hardening of the cement. They are manifested both in the ordinary process of hardening under water and in air. But they also appear to be quite active in the alternate hardening process, as explained above.

Nothing much is known about the forces which retard the hardening of cement and reduce its strength. The question naturally arises as to what name should be given to these forces, but, however interesting that may be, it is of little practical value.

Power and Mechanical Show Set for December

The Seventh National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York City, will be held this year from December 3rd to 8th, inclusive. Coming as it does coincident with the annual meeting of the American Society of Mechanical Engineers, an attendance of the country's best engineers is assured and the exposition should prove of great advertising value to the manufacturers. The care used by the Committee in seeing that only reputable manufacturers are permitted to exhibit gives those who do so a stamp of approval which should be of great value to them.

The Exposition during its seven years of existence has proved to be a tremendous economy for both exhibitors and visitors. It is the best medium for the manufacturer to meet and demonstrate his products to the users, and the visitor to the show can obtain a complete cross section of the achievements of the Mechanical Engineering industries and the developments which have been accomplished in them during the year. Actual visualization of these improvements helps the visitor to decide what materials and equipment will increase his dividends by improving production and products and by lowering his cost so that the selling price may be reduced. Such conditions can only be accomplished by building up broad and educating exhibits that cover the entire field of industry.

The fact is that there is no industry that does not depend on mechanical equipment and engineers in order to exist and that there is no individual or group of individuals who does not benefit directly or indirectly by the mechanical equipment shown at the Power Show. The comparisons permit the manufacturer to keep abreast of the developments in his own and allied fields and open the way for his representatives to follow up the visual demonstrations of his products and complete his sale. That this is appreciated by the manufacturer is evidenced by the fact that never in the seven years of the existence of the show has so much space been taken in advance.

The manufacturer whose product has merit and will meet the needs of the engineering industry and stand the inspection of inquiring seekers of materials, machines, instruments of precision, and numerous items used in industry, will find that the opportunity afforded to get his products before his prospects is one of the best sales mediums to be found. Contacts made with buyers of equipment, renewing old acquaintances and discussing problems with the manufacturers, establish a clearer understanding of the industry's needs.

Ferrous Oxide a Metallurgical Mystery

The Pacific Experiment Station of the United States Bureau of Mines, Department of Commerce, in its work on the determination of physical and chemical properties of the oxides of metallurgically important substances, has encountered the problem of preparing pure ferrous oxide. It seems to have been prepared pure by previous investigators only in minute amounts of less than 1/10 gm., whereas samples of several pounds are desired for the usual determinations of specific heats, heats of formation, etc. The oxide is metastable below 500 deg. or 600 deg. C., and must be prepared above and rapidly chilled through this range, even to produce relatively impure material. A common method of preparation has attempted to reduce magnetite by means of metallic iron. Experiments carried out in a specially designed high-frequency induction furnace of vacuum type, and provided with a specially efficient means of chilling the product, showed that repeated treatments of fused iron oxides with pure iron between the melting point of the oxide and that of the iron, consistently gave only about 85 per cent limiting purity. This constitution seems to be a steady or equilibrium condition, and the proof that such limits exist has important bearing on certain problems involving ferrous oxide, not only in connection with the metallurgy of iron, but also with studies of the condition of copper-smelter, slags, and mattes.

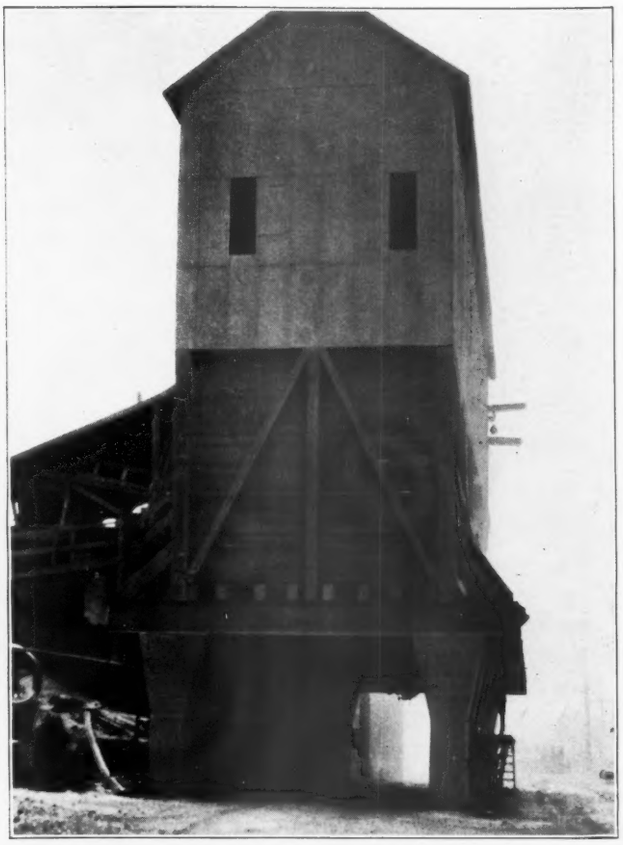
ORGANIZATION A FACTOR IN REBUILT PLANT OF BELMONT GURNEE COMPANY

By George Ransom

THE trap rock quarry of the Belmont Gurnee Company at West Nyack, New York, is a 750 ton per day operation which has several points of particular interest. Not the least of these is the organization of the personnel which Mr. Vincent N. Colarell, the superintendent, appears to have carried out with a great deal of care. Much care has been taken in selecting men who can be trained to take several different stations in the plant such as at the drills, trucks or in the mill so that they will always be busy, and no part of the operation will suffer in case of the inability of some one to attend to his usual work. Furthermore it is more interesting for the men and more likely to develop their capabilities.

Another matter of management which seems highly practical is that the master mechanic, the blacksmith and one or two others have their lunch before the regular noon hour shut-down. Then when the plant is not running they go through it carefully, greasing the machinery, tightening up wherever necessary and making other minor repairs. In this way it is, as a general thing, possible to avoid forced shut-downs. The drill sharpener also takes his lunch early so that he can be getting things ready for the drillers during noon hour.

The breast of the quarry is about 100 feet high. Tunnel blasting is the system employed and when



Crushed Stone Bins and Loading Space

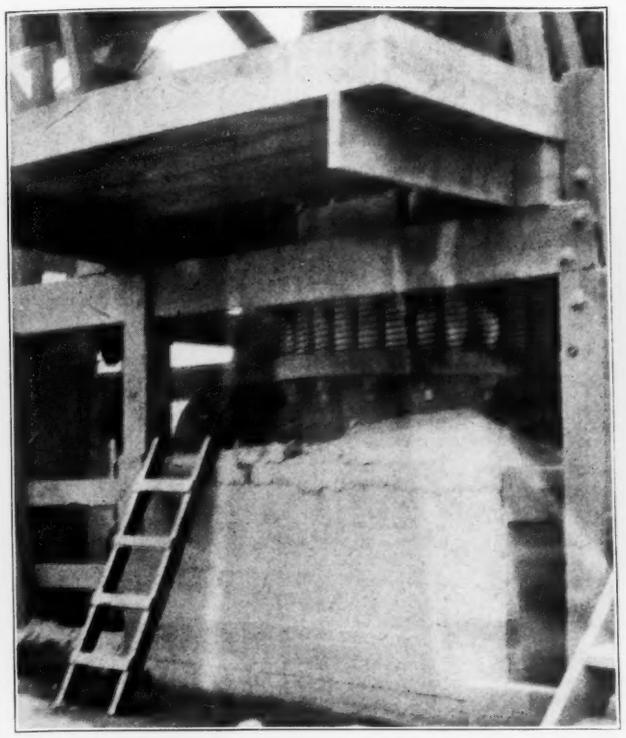
Drilling Crew of Belmont Gurnee Company

View of the Face of Quarry

this is done the tunnel is made 50 feet in and 50 feet each way for a height of 100 feet and in proportion when the height varies. Forty per cent Dupont or Red Cross Extra explosives are used. About 50,000 tons were thrown down in the last blast. Sixty per cent dynamite is used for secondary blasting. Cleveland 44 drills and Ingersoll Rand X70 drills are used in preparing for the blasts. One of the features of the quarry is the very clean floor, due to the fact that it is picked up by the drillers after every shot is fired.

At the face of the quarry a number 37 Marion electric shovel equipped with an Amsco manganese dipper picks up the stone and loads it into trucks. There are three Pierce Arrow trucks with 5 yard bodies and Wood hoists to carry stone to the primary breaker. Each can carry a hundred loads in a day but as a general thing only two trucks

Shovel Loading Truck from Stockpile with Personnel in Foreground



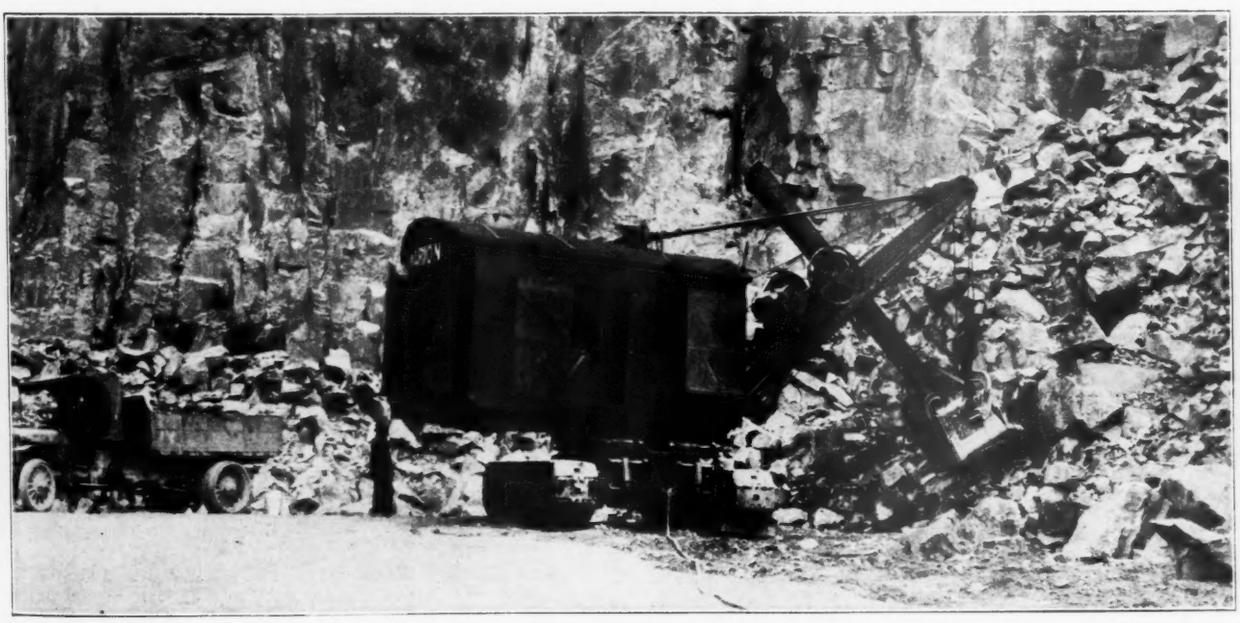
Cone Crusher

operate on this service at a time. They have been in use for a long time and apparently give excellent service.

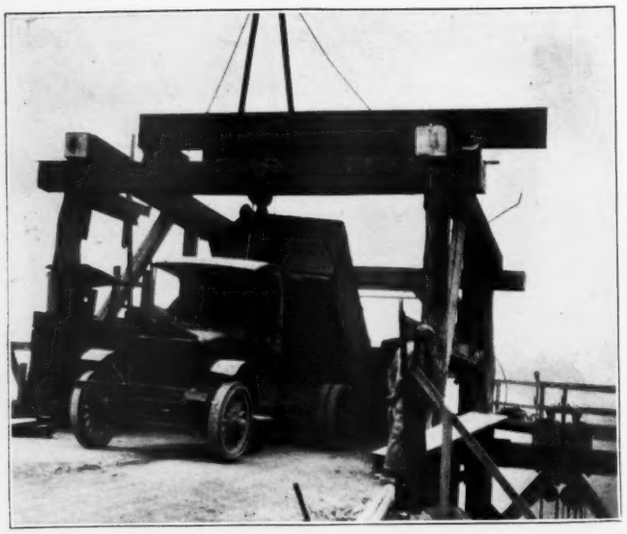
As the truck approaches the place where the load is to be dumped into the primary crusher the driver can tell by a signal light whether the crusher is running or not or whether for any reason dumping should be deferred, as when a jam has occurred. When the light is on it is all right to discharge the load but if it is off there is some reason why it should not be dumped. This rule is very scrupulously obeyed and is the means of avoiding much trouble and delay.

Conveyor to Cone Crusher

The primary crusher is a 42 by 60 Farrel driven by a 200 h.p. General Electric induction motor with a 24-inch eight-ply Goodyear endless belt. In fact practically all the power belting in the plant is



Shovel Working at the Face of Quarry



Dumping Load of Quarried Stone at Breaker

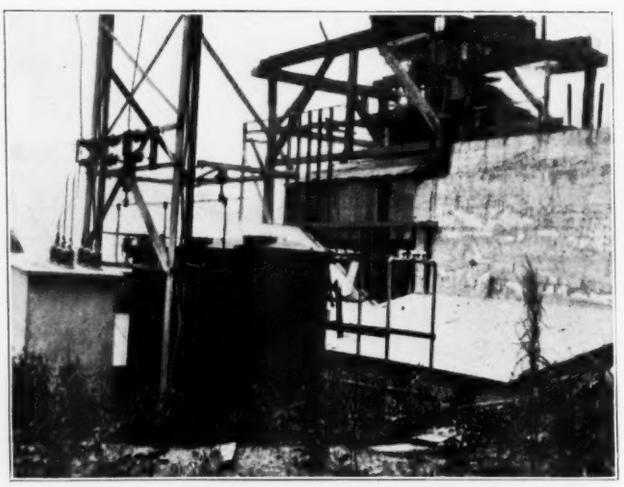
Goodyear. The rest of the plant, except the air compressor, is driven by a 350 h. p. General Electric low speed induction motor running at 300 r.p.m. and direct connected to the main line shaft. It was installed last February and has been very successful. This fits in very well with another feature of the plant which is that all the machinery is in line, making also, a very compact plant and enabling it to be run with only three men.

From the primary crusher the stone drops to a number 8 Kennedy gyratory crusher whence it again drops to an elevator. This carries it to the revolving scalping screen made of Rolman double lock woven manganese steel having 3¼-inch square openings and jacket of double lock woven manganese Rolman steel with ¾-inch square openings. The 2½-inch and 1½-inch sizes are taken out and dropped into bins. The ¾-inch sizes and under pass on a belt conveyor to the finishing screen where the sizes are separated and are also dropped into bins.

Moving Large Block at Quarry Face

The tailings from the scalping screen pass to a 36 by 10 Farrel jaw crusher and a 6-inch Bulldog gyratory crusher and the 2½ and 1½-inch sizes, when not wanted, are taken on a belt conveyor to a Symons cone crusher. Actually the two large commercial sizes and the scalpings intermingle more or less and become distributed among the three tertiary crushers. All of the latter discharge into the elevator which carries them back to the scalping screen.

Compressed air is supplied by a Chicago Pneumatic compressor driven by a 125 h.p. General Electric synchronous motor. Of course this tends to maintain a satisfactory power factor. Electrical power is furnished through a 1,000 h.p. transformer bank on the central station transmission line.



Transformer Bank and Lightning Arrester

Of course there are at times large stock piles of crushed trap rock. They are made by trucking from the bins and a No. 32 Marion shovel is used to load trucks or freight cars for shipment. There are four Pierce-Arrow trucks with Wood hoists for making deliveries and there is also a siding from the West Shore R. R. for railroad shipments. A Meyer railroad scale has been provided. There is also a Leyner drill sharpener. The plant was designed and rebuilt by Mr. Colarell and is now operated with twenty men.

Lime Burning With Powdered Fuel

In order to avoid the dead burning of the lime when firing with powdered coal, in spite of the high temperature of the coal dust flame, the nearly burned lime is passed over the exit of the exhaust gasses of the burning process. A. B. Helbig (German Patent 458,374). C. A.

AN ANALYSIS AND CLASSIFICATION OF WAGE SYSTEMS

By J. J. Berliner

PROBLEMS of wage payment occupy a position of central interest in the industrial world. "How much do you pay?" "What is a fair day's wage?" These two questions are immediately put by workers on the one side and employers on the other. The question of wages presents one of the most difficult problems to be solved by industry today. The methods which have been devised for remunerating labor may be classified into three groups as follows:

1. Time work, in which the employee is paid by the hour, the week, the month, or the year.

2. Contract work, which includes different payment plans, such as (a) the ordinary piece-rate method, (b) the differential piece-rate method, (c) the collective contract, whereby a contractor agrees to furnish the labor for a certain quantity of product at a certain price, the contractor selecting his own method of paying those who work for him.

3. Bonus, efficiency, or premium systems, including (a) promotion systems under day rate as a reward for increased efficiency, (b) the Halsey premium system, (c) the Rowan premium system, (d) the bonus system; (e) the efficiency system, (f) combinations of the above.

Time Work

With time work in its usual form, there is no record of the individual's performance. There is no incentive for effort except of such a sort as will result in the employee's recognition as a good worker by his superior, and as such increase his chances for promotion. On the other hand, there is really no penalty for ordinary inefficiency or time-killing as soon as a reward is introduced for individual efficiency, a departure is made from the traditional time work or day rate, even though the reward may be of a sort which is not recognized among the so-called bonus or premium systems of pay.

As regards time work, one of the surest ways of cutting down on the waste of materials and labor is by the introduction of time and motion studies. By time and motion studies, plus standardized routing, scheduling, moving of materials, and functional foremanship, many economies will ensue. But it must be noted that unless the proper inducements are offered to employees for the extra effort necessary to follow the various instructions, together with penalties attached for failure to put forth such efforts, only a fractional part of the advantages of standardization and planning will be realized. Proper supervision as well as standardization and planning, and good working conditions, such as are developed by proper welfare activities, will go a great way toward remedying time losses under a day-rate system. In fact, these conditions are necessary in the introduction of any kind of wage system.

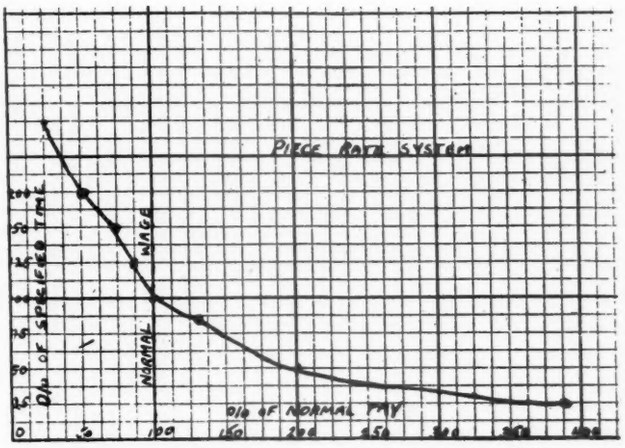


CHART 1 - PIECE RATE - DEFINITE RATE PER PIECE NORMAL PAY INCREASES WITH INCREASED OUTPUT AND DECREASES WITH LESSENED OUTPUT

Ordinary Piece Rate

Piece rate system is the plan of paying for measurable results rather than for time service. At first thought, ordinary piece rate would seem mathematically fair. The system, however, has been so badly abused that there exists at present a tremendous prejudice against it.

Piece rate has been used as a bait to speed up employees to a certain pace and then, when the pace was reached at which certain workers would earn more than the management considered they were worth, the rate was cut. After several such cuts the system produced nothing but fear and hostility, together with intentional loafing on all new work, so as to get the piece rate set as high as possible, since it was bound to be cut. If piece rate is to be used at all, it must be accompanied by a guarantee that there will be no change in rate so long as methods, tools, and machines are not changed.

However, where time reduction results through improved machinery and is in no way the result of effort on the part of the employe, a change in rate does not constitute a cut. Chart 1 shows how normal pay increases and decreases under ordinary piece rate.

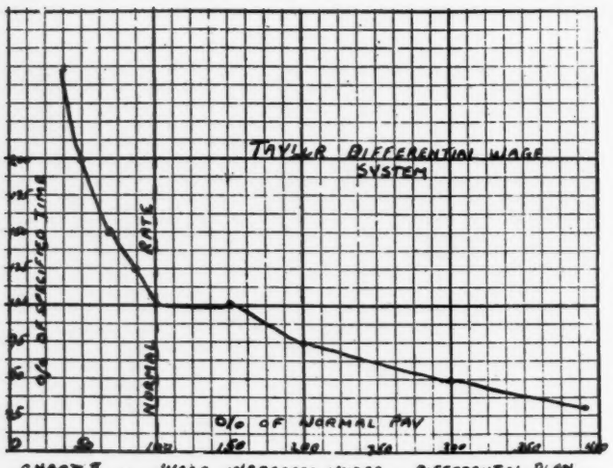


CHART II - WAGE INCREASES UNDER DIFFERENTIAL PLAN AT A MORE RAPID RATE AS TIME PER PIECE IS REDUCED

Differential Piece Rate

The differential piece rate consists of two rates: (1) the ordinary piece rate, which is paid a man for a normal or ordinary output, and (2) a higher rate, which is paid per piece, if a man turns out more than an ordinary output. Under the differential piece-rate system the workman not only has nothing to fear of the rate being cut, but he has a tremendous incentive to earn high pay, in view of the fact that he receives an exceptionally high reward for accomplishing good results.

For example, assume that, as the result of time study, it is shown that a piece of work can be done in 15 minutes. In order to allow for necessary rest periods and avoid lost time, 60 percent is added to the possible time, an increase of 9 minutes as an incentive, making 24 minutes the normal or average man's time. In an eight-hour day we should have 480 minutes; hence, the normal average output of an ordinary man would be 20 such pieces. Under the differential piece-rate system there would now be two rates offered, say, for example, 30 cents per piece for an output of 20 or less, and 32 cents per piece for an output of more than twenty. Thus, if the man produces 20 pieces, his earnings for the day would be $6.00, whereas if he turns out twenty-two pieces his earnings rise to $7.04. The company can afford to offer the increased piece price, because the cost of operating a machine tool, including power, light, heat, rental, repairs, etc., is likely to be as great as the rate of the man who is operating the machine, and the day rate of the machine remains very nearly stationary while the output increases. Chart 2 shows how, under the differential piece rate, the pay per piece increases at a more rapid rate as time is reduced than under ordinary piece-rate.

This last point may be illustrated mathematically. Let us assume in the above case that the cost of operating the machine is 40 cents an hour. The formula for determining the direct labor and machine cost per piece will be as follows:

$$\frac{\text{Machine rate} \times \text{hours} \times \text{piece rate} \times \text{number of pieces}}{\text{Number of Pieces}} = \text{cost per piece}$$

Thus if a workman turns out only 16 pieces during an eight-hour day, the cost per piece then will be:

$$\frac{35\times8\times30\times16}{16} = \frac{760}{16} = 47\tfrac{1}{2}\text{c}$$

If, on the other hand, a good workman turns out 22 pieces, the cost per piece will be as follows:

$$\frac{35\times8\times32\times22}{22} = \frac{984}{22} = 44.3\text{c}$$

From the above illustration, it is seen that the workman who produces only 16 pieces earns $6.00 per day and the cost to the employer is 47.5c per piece. On the other hand, the workman who produces 22 pieces earns $7.04 per day, while the cost to the employer is only 44.3c. This illustrates the fact that under a properly adjusted wage system of the differential piece system, both employer and employee may profit.

Contract Work

Where work is repeated over and over again in considerable volume, the practice exists of making a contract with competent workmen whereby they are to furnish a certain number of pieces at a specified price. Under this arrangement, the contractor employs his own men, while the company furnishes the material, buildings, equipment, tools, etc. Perhaps the most satisfactory reason for the employment of contract work seems to be that organized labor will submit to a brisk pace when imposed upon its members by a contractor who is himself a member of the organization.

Halsey Premium System

In the premium system devised by Mr. F. A. Halsey, the workman receives his hourly rate, and

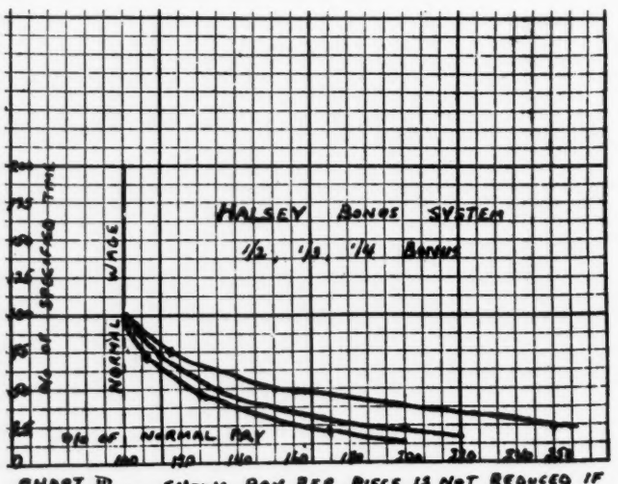


CHART III - SHOWS PAY PER PIECE IS NOT REDUCED IF MORE THAN SPECIFIED TIME IS CONSUMED AND PAY IS INCREASED AS TIME IS REDUCED

in addition to this receives extra pay every time he does the work in less time than the standard time. The time standard originally used by Mr. Halsey was the average of the records of previous performance. At the present time, however, the time standard is usually taken from 40 to 60 per cent higher than the time in which a skilled workman can do the work under correct conditions, such time standards having been established by a scientific motion and time study made during demonstrations by a skilled mechanic. The method of figuring wages under the Halsey premium plan is expressed in the following equation: (See also Chart III.)

Wages equals the time taken × the hourly rate × the time saved × a fraction of the hourly rate.

The usual fraction of the hourly rate is 50 per cent, prior to the general acceptance and introduction of accurate motion and time study made on demonstration by skilled workmen as a basis of

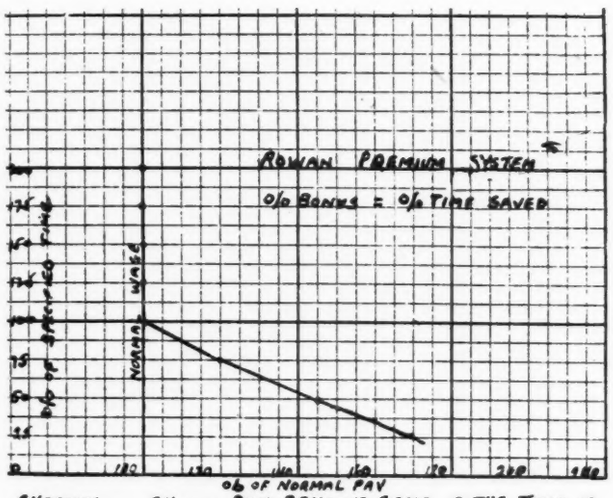


CHART IV - SHOWS PAY REMAINS SAME IF THE TIME IS NOT REDUCED AND HOW IT INCREASES AS THE TIME IS REDUCED

time standards, various systems were used which sought to establish a diminishing premium scale as the time was reduced below the time standard. These systems sought to provide a sort of insurance for employers who made mistakes in setting their time standards too high.

The following table shows some of the results actually obtained under the Halsey Premium Plan:

Time Allowed	Time Taken	Wages on Job at 30c per Hour	Premium ⅓ of the Value of the Time Saved	Workmen's Earnings per Hour	Total Labor Cost of Job
10 hours	10 hours	$3.00	0	.30	$3.00
10 hours	9 hours	2.70	.10	.311	2.80
10 hours	8 hours	2.40	.20	.325	2.50
10 hours	7 hours	2.10	.30	.343	2.40
10 hours	6 hours	1.80	.40	.366	2.20
10 hours	5 hours	1.50	.50	.40	2.00

The premium rate has the advantage that it does not set up fear as an incentive. Absolute guarantee should be made of the principles of time standards under the premium rate system, so long as methods, tools, and machines are not changed.

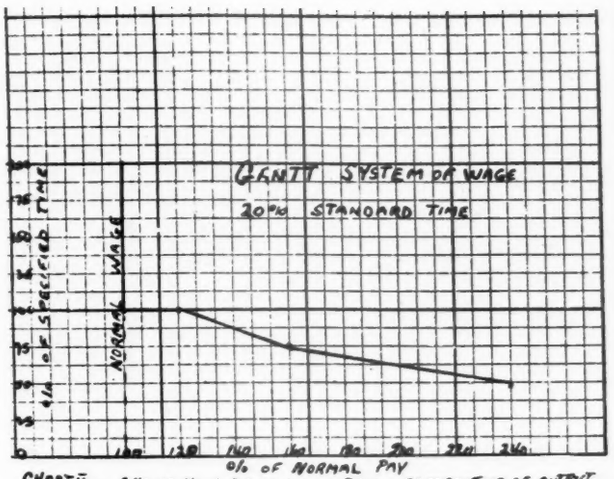


CHART V - SHOWS HOW DAY RATE IS PAID IRRESPECTIVE OF OUTPUT AND HOW PAY INCREASES AS TIME IS REDUCED UNDER GANTT SYSTEM

Rowan Premium System

This is a modification of Halsey's premium system devised by Mr. James Rowan. Time limits are established as under the Halsey system. The amount to be added, in case the time limit is reduced, is figured as follows: The premium equals the money value of the time actually taken to do the job, multiplied by the time saved and divided by the time limit. For example, if the time limit is 10 hours for a piece of work on which is employed a man receiving 30 cents an hour, and he does the work in 8 hours, then his pay will be 8 times 30, or $2.40 for his regular time; the premium to be added will be $\frac{2\times 2-40}{10}$ or 48 cents.

Further results of the application of the Rowan Premium System are shown in the following table (See also Chart IV).

Under this system, no matter how far the time

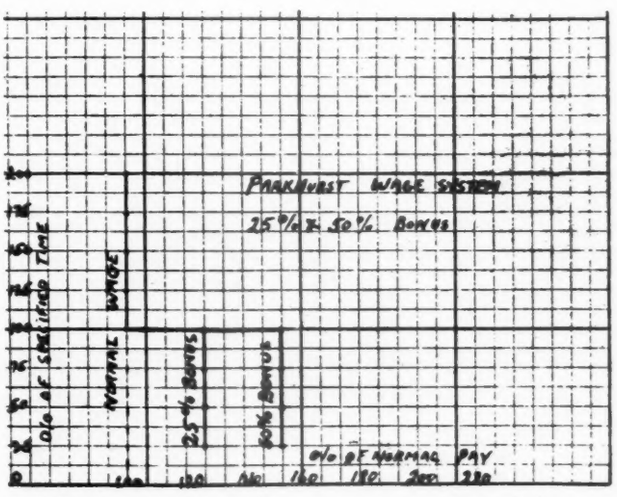


CHART VI - SHOWS HOW PAY ON THE INDIVIDUAL JOB BONUS SYSTEM INCREASES AS THE TIME IS REDUCED

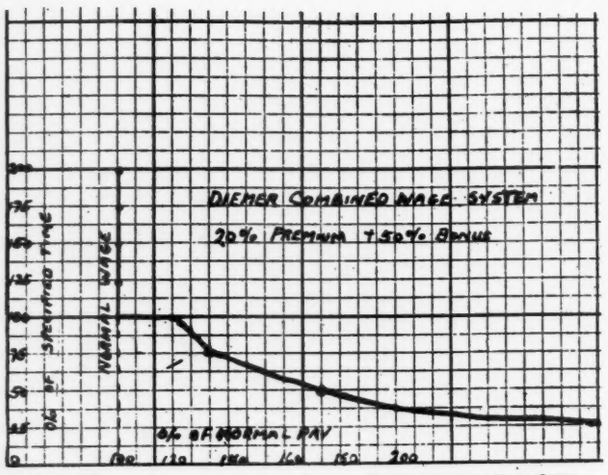


CHART VII - SHOWS HOW WITH A GUARANTEED DAY RATE THE PAY INCREASES AS THE TIME IS REDUCED UNDER THE DIEMER SYSTEM

is reduced, the premium will never be quite as great as the regular pay at a given time, so that the workman can never double his wages. Some of the objections raised against this system are that it requires a higher grade of clerical help to figure out the premiums than is needed with the Halsey system, also that figuring the premium is too complicated an affair for the workman, and that he will therefore become dissatisfied. Where the clerical labor and workmen are both of a high order of intelligence, these last objections will not hold good. Another objection made is on the ground that there ought to be no limit to the amount of premium or bonus which a man can earn. In reply to this, the statement is made that the management may have a very definite idea of the shortest time in which it is desirable to do a piece of work from considerations of accuracy, wear of machinery, and fatigue affecting the man.

Time Allowed	Time Taken	Wages on Job at 30c per Hour	Premium Money Value x % of Time Saved	Workmen's Earnings per Hour	Total Labor Cost of Job
10 hours	10 hours	$3.00	0	.30	$3.00
10 hours	9 hours	2.70	.27	.33	2.97
10 hours	8 hours	2.40	.48	.36	2.88
10 hours	7 hours	2.10	.63	.39	2.73
10 hours	6 hours	1.80	.72	.42	2.52
10 hours	5 hours	1.50	.75	.45	2.25

Gantt Bonus System

In this system time standards are established, but the employe is guaranteed a certain hourly rate regardless of his efficiency. If he does the work in the standard time he receives a bonus, usually from 20 per cent to 50 per cent, depending on the nature of the work. (See Chart V.)

If he does the work in less than the standard time, he receives the time rate for the standard time, plus the same bonus. In other words, the system is virtually a time rate for the man who does the work in more than standard time, and it is a piece rate for those who reach or better the standard.

Suppose, for example, that the standard time for a given job of work is eight hours, the rate of pay is 40 cents per hour, and the bonus is 30 per cent. If the man takes ten hours to do the work he gets 10 times 40 cents, or $4.00 for the job.

If he does the work in eight hours, he gets eight times 40 cents, or $3.20, plus 30 per cent on 8 hours —which is 96 cents. This makes his earnings $4.16 for eight hours, and his hourly rate is 52 cents. If it takes him six hours to do the work, he receives $2.40 for the time at work, plus 96 cents as a bonus, making his total wage $3.36 and his hourly wage 56 cents, as contrasted to 40 cents in the first instance and 52 cents in the second.

The purpose of this system is to secure to the workman his earnings while he is learning the job, and then pay him a sufficiently large bonus to keep him working at his highest rate of efficiency.

In addition to the bonus paid the workmen, a bonus is also frequently paid to the foreman. The foreman's bonus varies with the number of workmen in his gang who earn their bonus; i. e., it is larger if all the men in the gang succeed in earning their bonus than if only some of these are successful.

For instance, assuming that the foreman had 10 men under him, he would get 10 cents per bonusman, or $1.00 per day, if nine of his men made their bonus. If, however, all his men made their bonus, he would receive 15 cents per man, or $1.50. This system applies the differential piece rate for rewarding the foreman. There is an inducement for him to secure the highest efficiency from every workman.

It will be noted that the individual job bonus system recognizes 100 per cent efficiency on the individual job, but does not reward a man for his effort, in case he does not attain 100 per cent effi-

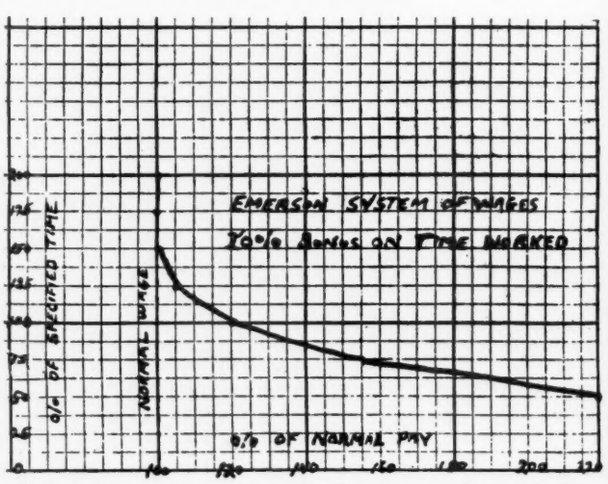


CHART VIII - SHOWS HOW WITH GUARANTEED DAY RATE THE PAY INCREASES AS EFFICIENCY INCREASES UNDER EMERSON SYSTEM

ciency. The payment of bonus on individual jobs demands a high grade of accuracy and integrity on the part of the person keeping the time record, so as to prevent the robbing of time from one job and putting it on another in order to favor the working man. Moreover, the most desirable employee is not the one who makes gains by occasional spurts, but one who averages high in efficiency. Under the individual-job bonus system there is no incentive to maintaining a uniformly high efficiency on all jobs. Chart VI shows how pay on individual-job bonus system increases as time is reduced. (Parkhurst Wage System.)

Efficiency System

Under this system a standard time is established for each job. During each pay period a record is made of the number of hours a man worked on the jobs on which time standards were established. Then the total hours in which he did these standard time jobs is divided into the total sum of the time standards. For example, if the sum of the standard times in a given pay period totals 210 hours, and the man took 240 hours on these jobs, then his efficiency would be 210÷240 or 87.5 per cent.

Mr. H. Emerson devised a sliding-scale for determining the bonus to be paid under the efficiency system. This scale is as follows:

Per Cent Efficiency	Bonus as Fraction of Wages
65	.0001
68	.0004
70	.0020
72	.0055
74	.0101
76	.0161
78	.0239
80	.0330
84	.0555
86	.0693
88	.0840
90	.1000

Above 90 per cent efficiency add the percentage above 90 to 10 per cent and the sum is the fraction of the wages to be paid as bonus. Chart VIII shows how with guaranteed day rate, the Emerson system rewards for increased efficiency.

Diener Bonus and Premium System

Under this system, workmen are paid a percentage increase of their wages such as 10% etc., if they reduce below past average the time in which the work is done. They are paid 20 per cent of hourly wage increase if the work is done in a specified standard time, such standard time being based on motion and time study, or demonstration by skilled workmen, and about 30 per cent being added to this time. A further so-called "gain-sharing bonus" on the Halsey premium plan was allowed if they did the work in less than the specified standard time. In addition to the bonus wages paid, a record was kept of every man's percentage of success during each pay period, and each man's percentage of success was made the basis of promotion in his hourly rate. (See Chart VII.)

Selecting a Wage System

In conclusion, it must be noted that the type of wage system to be introduced will depend not only on the extent of standardization, but also on whether the workmen are of a high or low grade of intelligence, and whether or not they are under the domination of strict union regulations in regard to wages. In general, we may state the field of the various systems as follows:

Where standardization has not been developed very far, time work with efficiency records is appropriate. Where standardization is under way, but has not been very well developed, the premium system is applicable. Where standardization is fully developed, the bonus system on individual jobs, the combined bonus and premium system, or the efficiency system can be used.

Flotation of High-Silica Bauxite

Experiments in the flotation of high-silica bauxite, being conducted by the United States Bureau of Mines, Department of Commerce, at its Southern Experiment Station, Tuscaloosa, Ala., have indicated that sodium sulphide is the most effective reagent for conditioning the pulp. The substitution of other causticizing reagents in place of sodium sulphide usually results in a greatly decreased recovery during flotation. It is significant, however, that sodium hydroxide and sodium carbonate, when used as conditioning reagents, will cause a considerable proportion of the bauxite minerals to float. Sodium carbonate is somewhat more effective than sodium hydroxide, but under the best conditions obtainable so far, neither of these reagents will yield a recovery exceeding two-thirds of that obtained by using sodium sulphide. In recent test runs, a solution of ammonium sulphide was used as a conditioning reagent. The action of the ammonium sulphide was from all appearances almost identical with that of sodium sulphide, but the recovery in flotation runs made on the conditioned pulp was only about 90 per cent of the recovery obtained under similar conditions when using sodium sulphide for conditioning.

HANDLING WELL DRILL HOLE MISFIRES

"HANDLING a misfire is by far the most hazardous duty any blaster is called upon to perform," according to H. H. Hamilton, technical representative for E. I. du Pont de Nemours and Company, Incorporated, "and he should proceed with every precaution for his own safety and that of the other men on the job." This is not a source of worry to the average blaster because he gives no thought to a misfired hole, other than to do whatever comes into his mind first and in many cases he does the wrong and dangerous thing.

When a well drill hole fails to fire, he points out, it falls into one of two classes: "First, holes which are so located that the total charge can be fired without danger to life or property; or second, holes which the original shot has robbed of part or all of the overburden so that the firing of the charge would be a hazard."

If the detonator is a good one, the wires uninjured and the failure due to poor connections or insufficient current, the charge may be fired by a second application of the current and, if this fails, a fresh primer must be inserted. The safest method for inserting a priming cartridge depends upon the material used for tamping. Of course, the depth of the stemming should always be measured and recorded so that it is known. In any case, the stemming must be removed.

Formerly, it was considered standard practice to drill a second hole parallel to the missed hole. It should be drilled at a safe distance, never closer than one foot from the missed hole. The object being to detonate the missed hole by concussion. This practice has been generally discontinued because, if the missed charge is not exploded, there is danger of throwing out unexploded particles of the charge. These may be later struck by a pick or shovel and an accident result. If this practice is followed, careful search should be made in the broken stone for unexploded explosives.

If the stemming is clay or loam, it is possible to use a pointed wooden pole, or a pipe with a sharpened wooden plug in the end, and work a hole through the tamping to the top of the charge, using water around the pole, or pipe while the hole is being punched. A new primer may then be pushed through the hole until it rests on the charge.

It is not so easy to put a hole through a stemming of sand or screenings. This may be done with a prospect auger or a small post hole digger. In using such a tool, great care must be exercised on nearing the charge so as to not touch the explosive. Sand stemming may be blown out with compressed air. The best method is to put a two inch pipe down into the hole and blow out the sand that rises in the pipe. The pipe will serve as a casing, if left in the hole, to prevent the remainder of the sand from caving in the hole. If compressed air is used, the hole should be kept drenched with water, especially if the charge is a granular explosive, or if a metal blow pipe is used. For this purpose a piece of stiff rubber tubing, fitted with a coupling so that it may be attached to the airline, is recommemded as a substitute.

If the exploding holes have broken the burden away from the hole or holes that failed, it is necessary to remove the explosive, which is a dangerous operation. A tool that has been successfully used is made by taking a copper or brass tube four or five inches in diameter and about 20 inches long with the edges of one end of the tube sharpened and having two holes drilled on opposite sides about half an inch from the sharpened end. Then run a 14 gauge copper or brass wire through these holes across the diameter of the pipe and fastening securely. The other end of the tube is fitted with a coupling to take a three quarter inch pipe so that a handle of any required length may be attached.

After the stemming has been removed with the prospect auger, the tube can be pushed into the explosive, which will rise in the tube. The wire will serve both to cut off the explosive, as the tube is twisted, and to hold the explosive in place until the tube is lifted and the dynamite removed. Water should be kept in the hole to soften the charge and prevent friction. After sufficient of the charge is removed to make firing safe, a new primer is put in and the hole tamped, preferably with water.

If holes of smaller diameter misfire, it is generally necessary to remove the tamping to insert a new primer. This may be done by using a blowpipe with compressed air or water pressure, or with a copper auger and spoon. If it is a bench hole that has not been sprung, the best procedure is probably to drill another hole beside it, from one to two feet distant, depending on the depth of the hole, and in such a position that a charge fired will break the rock away from the first hole so that the unexploded dynamite is recovered.

Mr. Hamilton emphasizes that "a large percentage of the misfires which occur could be prevented by making up the primers more carefully and, when electric firing is in use, by taking more time and pains with the final connections. Most blasters get in a hurry just before firing a shot and this is the very time one should make haste slowly."

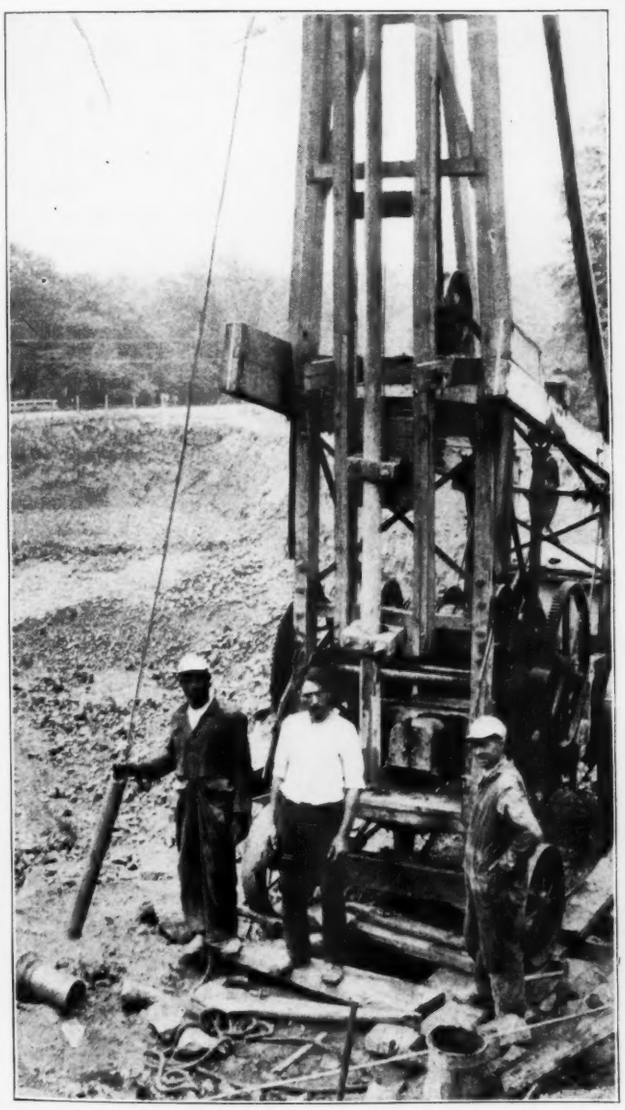
QUARRYING HARD NEW JERSEY TRAP ROCK WITH ECONOMICAL METHODS

By F. A. Westbrook

THE trap rock operation of Gennaro Lepre in South Orange, New Jersey, is most decidedly a family affair. He has four sons and a brother-in-law in the plant and his first cousin runs the contracting business of which he is also the head. Mr. Lepre came to this country when he was fourteen years old and first worked as a laborer for the Lackawanna R. R. Apparently he soon showed his mettle for before long he was given supervisory jobs wherever he went. For fourteen years he worked as superintendent of this same quarry which he now owns, since then he has added a general contracting business.

At the present time his son David Lepre, twenty-three years old, is superintendent, Anthony, the operator of shovel number 1, George, operator of

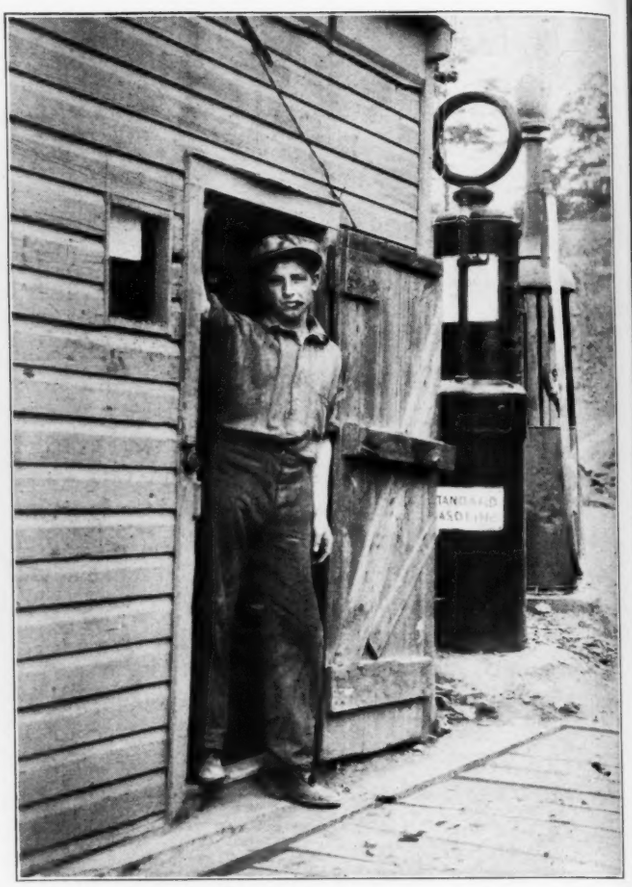
Face of Quarry with Well Drill



Well Drill and Crew

Greasing Primary Crusher at Noon

David Lepre at Door of Office



Lewis Lepre in Door of Scalehouse

shovel number 2, and Lewis presides in the scale room. Thomas Lieto, a brother-in-law, is operating superintendent. The unusual and delightful thing about this combination is that they all work harmoniously together and apparently have a very successful business.

The quarrying is being carried on very largely as a grading operation which it will take at least six years to complete. The district is one of fine residences and it is expected that the land thus made available for building purposes will be very valuable. With this end in view the quarry is not

Loading Trucks at Face of Quarry. Anthony Lepre, Shovel Operator

General View of Plant from Top of Quarry

being made deep and the strippings are being piled on the floor of the quarry for use in covering the rock later on. When this has been accomplished Mr. Lepre has another 60 acre tract which will be quarried later.

Drilling is done by a Keystone well drill and the holes are made to a depth of 5 feet below the floor of the quarry, 15 feet back from the face and about 15 feet apart. The explosive used is 60 per cent Hercules. The rock is of course previously stripped and as the soil is very thin it is done by a crew of three men who pile it up at the edge and later push it off. It is then loaded into trucks with the power shovels and taken to the storage piles on the floor of the quarry.

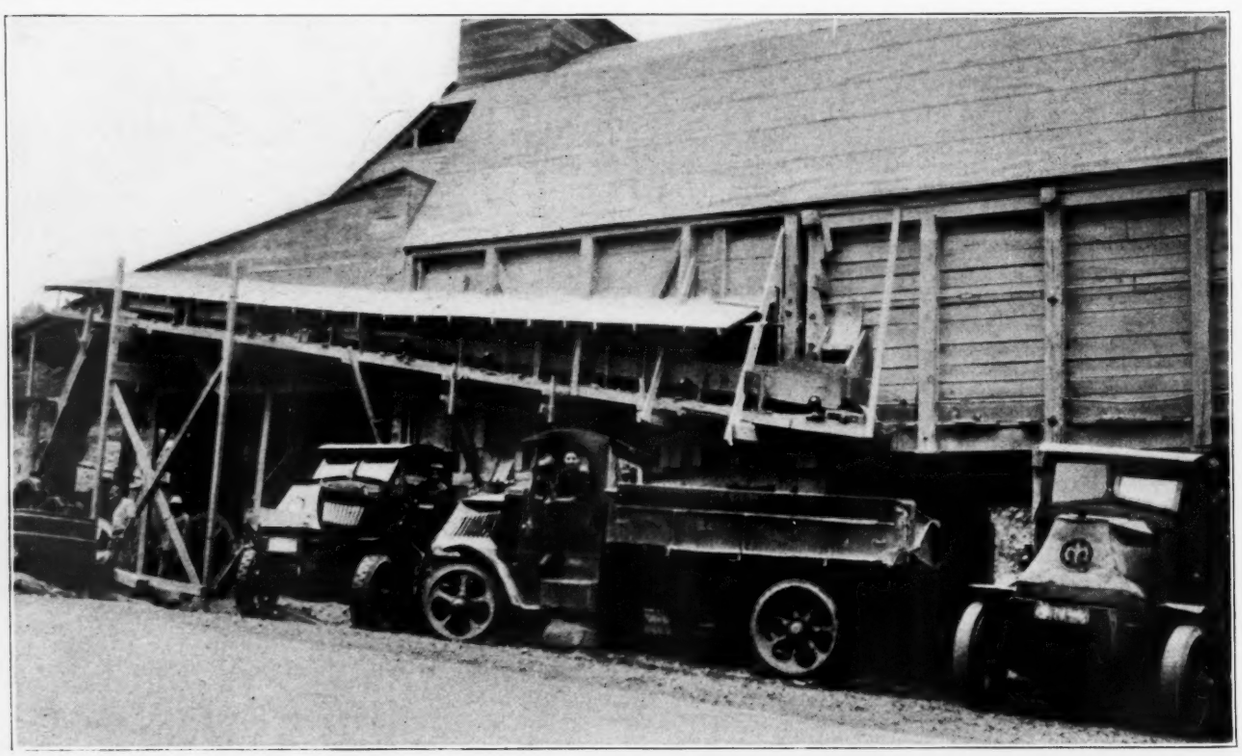
An Osgood 1-yard gasoline shovel is used at the face of the quarry to load stone into the two Autocar trucks which carry it to the primary crusher.

Dumping Load of Quarried Stone at Primary Crusher

Loading Truck from Stockpile. George Lepre, Shovel Operator

This is a 36 by 18 Farrel driven by a 100 h.p. Crocker Wheeler motor. From here the stone is carried on a Robins belt conveyor to the 30 by 13 Farrel secondary crusher. An 18-inch Farrel elevator then discharges it to an Earle C. Bacon 48-inch by 20-foot revolving screen which sizes it and drops the various sizes into separate bins. This screen is made of manganese steel plate sections.

The tailings from the screen pass by means of a Robins conveyor and chute to the tertiary crusher which is about to be replaced with a new 36 by 18 Farrel and which discharges back into the elevator to the revolving screen. A 125 h.p. General Electric induction motor drives the whole plant with the exception of the primary crusher. The transmission belts are from the Quaker City Rubber Products Co. The plant was completely equipped by the Earle C. Bacon Company.



Loading Trucks at Bins

Stone is sold to all who need it in the district and also for Mr. Lepre's own contracting business. The trucking is contracted for. As the bins are of limited capacity and the demand somewhat irregular, as everywhere, stock piles are a necessity. Trucks are loaded from these by a second Osgood gasoline shovel as shown in one of the illustrations.

A practice observed during the noon hour which does not seem to be as general as it should be is that of greasing the primary crusher. In fact the plant is gone over with considerable care every day in this way and it is doubtless one of the details making for the general apparent prosperity of the business. There is also a blacksmith shop with a Canedy forge blower which is used for drill sharpening and ordinary upkeep.

In the new office building there is a Victor adding machine and Remington typewriter and at the scale house a Meyer truck scale.

Three Year Federal Aid Plan

Two hundred and nineteen million, three hundred and seventy-five thousand dollars worth of good roads will be the Federal government's contribution to the cause of national progress during the next three years, according to the American Road Builders' Association. The sum to be allocated to each state under the federal aid road appropriation was made public by the association.

A total of $73,125,000 will be available to the states and Hawaii during each of the years 1929, 1930, 1931. The states must spend a minimum of $198,049,992 on the federal aid roads during the three years in order to take advantage of their federal appropriation.

"The annual contribution of the federal government constitutes less than 7 per cent of the cost of road construction and maintenance each year in the United States," the American Road Builders' Association declared. "It is less than five hundredths of one cent for each mile travelled by motor vehicles during 1928.

"The association asserted that good roads are a national as well as a local asset, and that the federal government should not only make its periodic appropriations perennial, but should increase them beyond the present limitations. The nation still has in excess of 2,000,000 miles of unimproved roads, much of which is in need of improvement."

The allocation of federal funds for 1929, 1930 and 1931 road construction in the United States and Hawaii, has been made by the United States Bureau of Public Roads. There may be a few minor corrections in the apportionments for 1930 and 1931 as a result of mileage revisions. With the exception of 13 states in which more than 5 per cent of all land is non-taxable, the states must finance at least 50 per cent of federal aid road costs, and in no case will the government contribute in excess of $15,000 per mile.

The apportionment to each state and Hawaii, and the minimum which may be expended on the same roads by the states, for each of the years 1929, 1930, 1931, is as follows:

State	Federal Apportionment	Minimum State Share
Alabama	$ 1,547,483.00	$ 1,547,483.00
Arizona	1,059,081.00	404,951.00
Arkansas	1,281,785.00	1,281,785.00
California	2,486,415.00	1,893,659.00
Colorado	1,383,401.00	1,083,484.00
Connecticut	474,213.00	474,213.00
Delaware	365,625.00	365,625.00
Florida	901,311.00	901,311.00
Georgia	1,980,015.00	1,980,015.00
Hawaii	365,625.00	365,625.00
Idaho	932,962.00	628,481.00
Illinois	3,135,225.00	3,135,225.00
Indiana	1,921,463.00	1,921,463.00
Iowa	2,035,291.00	2,035,291.00
Kansas	2,062,196.00	2,062,196.00
Kentucky	1,421,029.00	1,421,029.00
Louisiana	1,019,282.00	1,019,282.00
Maine	681,431.00	681,431.00
Maryland	634,906.00	634,908.00
Massachusetts	1,088,808.00	1,088,808.00
Michigan	2,209,596.00	2,209,596.00
Minnesota	2,112,595.00	2,112,595.00
Mississippi	1,309,729.00	1,309,729.00
Missouri	2,404,347.00	2,404,347.00
Montana	1,552,576.00	1,199,064.00
Nebraska	1,584,981.00	1,584,981.00
Nevada	957,995.00	134,115.00
New Hampshire	365,625.00	365,625.00
New Jersey	935,122.00	936,122.00
New Mexico	1,189,361.00	685,715.00
New York	3,629,879.00	3,629,879.00
North Carolina	1,715,910.00	1,715,910.00
North Dakota	1,193,440.00	1,193,440.00
Ohio	2,757,964.00	2,757,964.00
Oklahoma	1,749,066.00	1,405,815.00
Oregon	1,189,707.00	1,404,109.00
Pennsylvania	3,333,786.00	3,333,786.00
Rhode Island	365,625.00	365,625.00
South Carolina	1,059,533.00	1,059,533.00
South Dakota	1,223,981.00	976,632.00
Tennessee	1,612,012.00	1,612,012.00
Texas	4,502,576.00	4,502,576.00
Utah	848,093.00	226,803.00
Vermont	365,625.00	365,625.00
Virginia	1,437,548.00	1,437,548.00
Washington	1,143,226.00	962,152.00
West Virginia	793,796.00	793,796.00
Wisconsin	1,864,212.00	1,864,212.00
Wyoming	939,547.00	524,068.00
Totals	$73,125,000.00	$66,016,664.00

ALABAMA QUENELDA GRAPHITE COMPANY COMPLETES NEW PLANTS IN ALABAMA

THE Alabama Quenelda Graphite Company, with offices in Birmingham, owns 2,000 acres of graphite ore lands in Clay County near Ashland and Lineville, Alabama. The deposits, which are estimated at 50 million tons of 3 per cent graphite values, occur in a sand rock formation running in veins similar to coal, except that the graphite is found on the surface. The recently completed Peerless plant and the refinery at Lineville were to be tested out on August 1st, according to plans.

The graphite ore is mined by blasting and is loaded into gable bottom mine cars by a ¾-yard Marion shovel. The cars haul the ore to a number 7½ Telsmith crusher from which the crushed ore is carried by a 24-inch housed rubber belt conveyor 798 feet long to a storage bin at the head of the Peerless plant, which is a building with concrete foundations and 20-inch I beam construction. Leaving the bin, the material enters a number 5½ Telsmith crusher and is then screened by means of grizzly bars and rotary screens, the fines going directly to the flotation system and the coarse material to a number 64½ Marcy ball mill. From the ball mill the material also goes to the flotation system, which consists of several units of Callow cells in conjunction with Diester classifiers.

In this system the graphite is floated to the surface by means of forced agitation; pine oil, kerosene and other flotation oils being used to mulsify the gangue. The froth resulting from this process has a tendency to laminate with the flakes of graphite, bringing them to the surface, while the waste material, or tailings, are drawn off from the bottom of the cells. The graphite values are floated over the cells and are received by a second unit of Callow cells which partially clean the graphite. The recovered graphite then passes over a series of Wilfley tables and goes to a large vat, the floor of which is covered with 12 ounce duck, where some of the water is drawn off by a vacuum pump. The resulting product is known as "Concentrate" and

Panoramic View Showing Graphite Ore Deposits. The Electric

Panoramic View Showing Main Refinery Building, Warehouse,

is transported by truck to the refinery at Lineville, which is five miles from the Peerless plant.

The refinery building is four stories, of wood construction, and is located on 100 acres of land also owned by the company. The storage warehouse for the finished graphite and the supply house are also located on this property and a chemical laboratory is being equipped to test the product.

The concentrate on arriving at Lineville is weighed and deposited in storage bins, from which it is fed into a Cummar 54 inch by 40 foot, salamander type, rotary dryer. The dryer removes the moisture and volatile matter and the material is

Shovel Operations to the Peerless Plant Are On the Right. The Carbon Mountain Plant Is Just Over Top of Hill.

then elevated by means of a spiral conveyor and chain bucket elevator to a cooling bin in the top of the refinery building. Machinery is now being installed for the production of No. 1, No. 2 and No. 3 flake graphite and, when installation is completed, any desired grade can be furnished.

W. L. Shumate, Jr., of Birmingham, is president; R. B. Watts, of Birmingham, M. P. Kelly of Bentonville, Arkansas, F. R. Jones of Cartersville, Georgia, and Gordon Lee of Chattanooga, Tennessee, are vice presidents; Ray J. Emmerson of Birmingham is secretary, and Harry Kerlin, also of Birmingham, is treasurer. A. E. Enberg of Lineville, superintendent of mines and plants, has been actively engaged in the mining and refining of graphite in this district for the last twelve years.

Directors are: W. L. Shumate, Jr.; R. B. Watts, M. P. Kelly, Ray J. Emmerson, John L. Senior, Walter P. Andrews, A. L. Gwin, W. S. Blakeney, A. F. Hancock, Frank A. Drury, John Blue, Francis P. Butler, John W. Esmond, G. R. Harsh and Wm. H. Wildes.

Graphite—sometimes called plumbago or blacklead—occurs naturally in two forms, the amorphous and crystalline, each form being subject to variations due to the incidents of its occurrence. Amorphous graphite does not occur pure, but is always associated with other earthy materials, the character of which have great bearing on its use. Crystalline graphite shows great variations also, because of the distortion of its crystals during the process of formation. Crystalline graphite occurs both massive and with its particles disseminated through a containing rock.

The crystalline graphite is supplied almost wholly from Madagascar, New York, Alabama, Ceylon and Korea. Most of the amorphous graphite

Supply House, Office Building and Spur Track Connection

used comes from Mexico, Canada and Rhode Island.

The uses to which graphite is put depend on the physical characteristics which it possesses, none of its uses, except that of a foundry facing, involving a chemical reaction. These physical properties are its infusibility at temperatures below that of the electric arc, its great capacity for absorbing and transferring heat, its comparatively high electrical conductivity and its softness. It adheres readily to any surface with which it comes in contact and is highly polished by slight friction.

Amorphous graphite and clay are ground to the finest possible state of division, mixed, filtered, and formed into cakes by means of hydraulic filters; it is then again mixed by repeatedly forcing it through plates perforated by many minute holes. It is then placed in hydraulic presses and forced through dies into the shape and size required. It is laid out straight on boards, and, when dry, is cut into proper lengths. It is then packed into plumbago crucibles and fired in kilns. Upon removal from the crucible, the lengths are ready to be placed in their wooden casings. The grade of hardness depends upon the relative percentage of clay contained in the graphite mixture, the larger the amount of clay the harder the grade.

The components of the mixture, in a plastic condition, are put into a revolving mold, the interior of the mold having the contour of the outside of the crucible; a rib having its forming edge shaped like the inside of the crucible and attached to the end of a lever, is drawn down inside of the revolving mold forcing the plastic mass into the desired shape. The crucibles are then dried thoroughly, this operation requiring from one to six weeks, depending on their size and the thickness of the walls. They are next set in kilns and fired, the temperature of the kilns being sufficient completely to eliminate the combined water from the clay. Immediately before use the crucible should be annealed sufficiently to drive off any hygroscopic moisture that may have been acquired during shipment or storage. The plumbago crucible is remarkable for its ability to withstand great shock, due to sudden changes of temperature. A crucible at white heat may be thrown into cold water without any apparent damage. Crucibles give way through actually wearing out, that is, the repeated formation of slag on the outside of the crucible during successive heats, gradually reduces the thickness of the walls until they become too thin to carry the weight of the metal put into them.

The practice of facing molds, in which castings are to be made, with some carbonaceous material, is to prevent the adhesion of the iron to the sand of the mold. In order to secure perfect results the facing must adhere perfectly to the mold-surfaces. The hot metal coming in contact with the sand, dries out the mold, and if the facing has not been properly, compounded, it will be washed away in front of the advancing metal, hence it is necessary to have a certain percentage of clayey material mixed with the facing to prevent this. The facing must be slowly combustible. If the facing burns quickly, trouble is likely to ensure from: (a) too great a volume of gas to be readily vented, casing "blows" and "cold shuts"; the latter term being applied to those cases where the iron has not filled the mold, and (b) where combustion is too rapid, it is not likely to endure during the entire time necessary for the metal to solidify, thus giving opportunity for adhesion. Plumbago combines the requisites necessary to a good facing, and in addition can be polished, giving the smoothest possible surface to the mold.

The crystalline graphite is the only form suitable for lubricating purposes. The amorphous kind is always associated with impurities. The true function of graphite as a lubricant is to change the character of solid friction, the co-efficient of friction of iron on iron being changed to that of iron on graphite, which may be taken safely at 60 per cent less. The laminated form is most suitable for lubricating purposes. Prepared for market, it is irregularly circular in shape, having an average diameter of 1/40-inch. The thickness of these flakes varies from 1/500-in. to less than 1/4000-in. A bearing lubricated with graphite is not liable to "Seize" while running hot.

In making a wax-impression of a type form, halftone cut or engraving, graphite is applied to the face of the wax-case to prevent the adhesion of the type form. For this purpose it must be very fine, and of such a character that it will not pack in masses that would cause minute blotches on the mold. Its second function is to supply a conductive coating to the surface of the mold. This is done by highly polishing the surface with graphite of the greatest purity and fineness by means of fine hand brushes.

Considerable quantities of crystalline graphite are used for glazing gunpowder, in order to prevent the absorption of moisture, which would result in caking.

Stove polish consists of two components, the graphite which imparts the polish, and the clay binding-material which holds it in place. Amorphous blacklead can be used without any admixture, but the addition of crystalline graphite gives a more brilliant and enduring, but grayer lustre.

Paint made with graphite as a pigment seems to have all the durability of lampblack with the advantage of drying in a reasonable time without the addition of excessive "dryer." As a pigment graphite is absolutely inert, producing no

(Continued on page 77)

BOND IN SLAG AND SLAG CONCRETE

THE National Slag Association of Cleveland, Ohio, has published Symposium number 5 of a series pertaining to the characteristics and uses of blast furnace slag, prepared by the association for presentation to its members and to the membership of various committees in a number of technical organizations. This article is an abstract of the Symposium "Bond in Slag and Slag Concrete."

Bond of Steel with Concrete

One of the earliest bond tests was that carried out by F. C. Lea and R. C. Stradling at the University of Birmingham, England, in 1915. In commenting on these tests the "Canadian Engineer" in an article appearing in the March 27, 1923 number, entitled "Bond Strength of Slag Concrete," says that slag concretes at the age of nine months possess an adhesive strength at least as great as that of gravel concretes, and in some cases more.

An article, "Slag as an Aggregate for Concrete Ships," appearing in the July 18, 1918 number of the "Iron Age" gives the results of tests conducted by Professor Curtis C. Myers at the University of Cincinnati, Ohio. A test of two 1:2:4 concretes indicated that the bond between steel and crushed stone concrete at the end of two months was 505 pounds per square inch and in the case of slag concrete 610 pounds, the difference holding nearly constant for a 16 months' observation period.

Bond of Slag with Mortar in Concrete

Sanford E. Thompson, in an article, "Slag as Concrete Aggregate," appearing in the 1917 Proceedings of the American Concrete Institute, says that the strength of the concrete is substantially the same whether the slag be porous or dense, giving as a reason that the solid part, even of the porous slag, is very strong and that the pores are filled by the mortar. Inspection of the crushed specimens where breaks occurred through the pieces showed a very strong bond between the mortar and the slag. This, according to Mr. Thompson, was due not only to the rough surface of the slag but also to the chemical action which had evidently taken place between the slag and the mortar.

Lea and Stradling in an article, "Adhesion of Steel and Concrete," in the October, 1922 number of the "Concrete and Constructional Engineering" magazine, state that fractures in slag concrete always go through the large aggregate and not around it, as is the case with most other aggregates.

"Comparative Tests of Slag and Stone Concrete," appearing in "Engineering and Contracting," April 30, 1913, states that blast furnace slag as an aggregate for concrete has several merits. The slag has cementing properties in itself, breaks up into unusually good forms, and has a porous texture which helps the bond of cement and aggregate.

W. D. Brewer, in a paper, "Blast Furnace Slag," presented before the meeting of the Testing Engineers and Chemists of State Highway Departments, February 25, 1920, says that slag, when incorporated in the mix of concrete, is bound very firmly, greatly reducing the danger of ravelling that starts with pulling out one piece of the aggregate.

J. P. Nash in "Tests of Concrete Aggregates Used in Texas," appearing in the University of Texas Bulletin 1771, December 20, 1917 observes that slag concrete is rather more difficult to mix well than gravel or stone concrete, but once mixed has less tendency for the slag to separate from the mortar.

Bond of Slag Products with Mortar

Josiah Butler in "Manufacture of Concrete Bricks from Blast Furnace Slag," in the January 24, 1908 number of the "Iron and Coal Trades Review" says that mortar adheres to these brick as well as in any work done with red brick.

Dr. A. Guttman in "Use of Slag in the Building Industry," published in Germany in 1919, states that slag-lime stones made in Germany hold the mortar so firmly that loosening of masonry work is prevented.

Bond of Slag with Bitumen

A. Dryland in "Notes on English Bituminous Road Practice" in the "Engineering News Record" May 29, 1921, says that tar-macadam roads using slag as an aggregate are highly approved in England, the large number of pinholes and slight honeycomb indentations giving it the porosity necessary to retain tar in ideal quantity.

The United States Department of Agriculture in Bulletin 94, published June 22, 1911, gives the results of test sections of secondary roads built by the U. S. Bureau of Roads with the object of finding a dust preventative. The section treated in this experiment in which slag was used with coke oven tar showed up to better advantage than any of the others. The surface was perfectly bonded and, although the road was constructed on a fresh fill which had settled since, the tar slag surface showed no signs of cracking in adjusting itself to the settlement.

B. A. Anderton, in a paper, "Use of Slag in Bituminous Road Construction," presented before the meeting of the National Slag Association, March 28, 1924, says that the partially cellular

structure of commercial slag aggregate introduces a factor of uncertainty in the proper control of a bituminous slag mixture which could probably be obviated by securing a supply of aggregate uniform as to character of fragments.

Bond of Slag in Macadam

W. D. Brewer in a paper, "Blast Furnace Slag," presented before the February, 1920 meeting of the Testing Engineers and Chemists of State Highway Departments, says that the principle involved in building a water-bound macadam road is to place the material in the finished road so that it approaches as nearly as possible the solid state of the material before it was crushed and screened. Slag has a higher cementing value than most building materials and actually cements into a solid mass after a short time in the road.

C. L. McKenzie, in "Utilization of Iron and Steel Works' Slags," by E. C. Brown, in the 1926 Proceedings of the Engineers' Society of Western Pennsylvania states that cement is suitable for waterbound macadam because of its cementing qualities and because it wears uniformly, as well as because of the facility with which it bonds together mechanically.

Cementation of Slag

N. A. Sager in "Why Not Use Slag," a booklet published by the Illinois Improvement and Ballast Company in 1905, says that slag which was laid as a foundation for streets in Chicago 15 years previously had bonded together so firmly and was so hard that it had to be undermined and broken down with a sledge hammer.

The "Engineering Record" quotes a similar case in "Blast Furnace Slag for Pavement Foundation," in the May 23, 1903 issue. A pavement of asphalt block 4 years old in Niles, Ohio, laid on blast furnace slag six inches thick had to be taken up in several places for sewer and water connections and the base was found to be so hard that sledges and iron bars were necessary to break and pry it out.

Cementation Tests of Slag

Tests for the cementing properties of slag are made on a cylindrical briquette, 25 mm. in height and 25 mm. in diameter, molded from a mixture of finely ground slag and water. The briquette is subjected to the blows of a 1 kgm. hammer falling 1 cm. and the number of blows required to break the briquette indicates the cementing value (CV).

Cementation tests on various slags at the U. S. Bureau of Roads, reported by E. C. E. Lord in a report, 1909, gave cement values ranging from 3 to 596, the lower values being glassy slags seldom encountered commercially, and the higher the more common basic slags.

Tests at the Ohio State Highway Department Testing Laboratory in 1917 showed values ranging from 4 to 119; and tests conducted by the U. S. Bureau of Roads from 1902 to 1915 gave values from 2 to 500.

Solubility of Slag

Dr. J. E. Stead in "Blast Furnace Slag in Concrete and Reinforced Concrete," published in the "Engineering World," February and March 1919, gives some information on the extent of solubility in slags which had been subjected to various cooling processes. According to Dr. Stead, portland cement and blast furnace slag are both partially soluble in water as shown in the following tests. Finely ground portland cement and slags were respectively shaken up with 500 c. c.'s of distilled water for half an hour. The amount of lime dissolved was: (slag 0.35 to 1.40 per cent; portland cement, 4.00 per cent.) It was observed that the most lime was dissolved in the slowly-cooled slags, less in the chilled and reheated slag, and the most in the portland cement.

Lead acetate added to the solutions formed a precipitate of lead sulphide, indicating that a soluble sulphide had passed into solution. Percentages of the lead sulphide were from 1.30 to 2.81. It was observed that more sulphide was disssolved from the slowly-cooled slag than from the chilled.

Texture, Density and Surface Area of Slag

An article in "Scientific American," July 1925, "Putting Slag to Work," states that slag, when crushed and screened, breaks down into roughly cubical dimensions of rather large surface area on account of pits and projections on its faces.

Sanford E. Thompson in "Slag as Concrete Aggregate," from the 1917 Proceedings of the American Concrete Institute, says that porous slag produces a concrete of substantially the same strength at 28 days as the dense slag.

W. E. Donaldson in "Slag as an Asset, Not an Expense," published in "Iron Age, April 14, 1927, tells of experiments made by the Carnegie Steel Company to determine what character of material could be obtained by more rapid cooling of the molten slag. The result was an extremely dense slag, weighing over 100 pounds per cubic foot.

Fracture and Shape of Slag

The National Slag Association Bulletin for January, 1920 says that a mass of commercial slag is composed of roughly cubical fragments, most of which are irregularly pitted, giving evidence of cellular structure; the cells, however, are not communicating.

The Symposium states that the roughly cubical shape of air cooled slag is another point in favor of its bonding properties in concrete and macadam; the shape being dependent on the type of fracture.

ENERGETIC MANAGEMENT BUILDS BUSINESS FROM SMALL BEGINNING

THE Bloomington Crushed Stone Company, located about a mile west of Bloomington, Indiana, although a hand operated quarry, presents a good example of a growing business which has been developed from a small beginning by energetic management. During the past year a new crusher has been installed, a set of shaker screens added and the storage capacity doubled by the construction of four concrete bins. The additional equipment has resulted in a gratifying increase in the total production and output.

This quarry was first opened about eleven years ago by a pike road contractor to supply stone for the roads in that vicinity which he had under contract. The stone proved to be of such excellent quality that when it had served his first purpose he took in a partner and they began producing crushed stone for sale to other contractors and to county and road officials. Later it was sold to the present management and as the business grew, new equipment was added from time to time, and the sales of crushed stone increased. At the present time this plant supplies all the stone for street work in Bloomington, for state and county roads in Monroe county, and for a variety of other concrete work in that vicinity.

From this original plant the business has grown and expanded until the company now operates ten other quarries and crushing plants as subsidiaries to the main plant at Bloomington. These are at Lanesville, Sullivan, Dolan, Leesville, New Albany, Corydon, Palmyra, West Fork, Salem and Cloverdale, Indiana. R. J. Rogers is general manager of all the plants, J. O. Hepley is chief clerk and James Kerr is quarry foreman of the Bloomington plant. An average of 25 men are employed at Bloomington.

The Bloomington plant is operating in a bed of Mitchell limestone about 50 feet thick. The company owns a tract of 15 acres, all desirable stone land. It is free from mud seams, which produces a good grade of crushed stone for road and concrete work, also a limited amount of finer screenings, used for agricultural limestone.

The overburden is about five feet thick, consisting of clay and soil, mostly red clay. A hydraulic stripping pump has been used here with much success, but this method of removing the overburden has been handicapped by the absence of a plentiful supply of water near the quarry and difficulties in disposing of the mud flow. A Koehring shovel, operated by gasoline, with a ¾-yard dipper is being used now for this work.

Two Ingersoll Rand air drills are used in the quarry to drill 1¼ inch holes about 14 feet deep. The number of holes varies with the shape of the ledge and the amount of stone required, but the usual number is about 20. They are placed about six feet apart and go straight down. The company owns ten drills, all of which are kept in the main stock room of this plant, and used to supply the other ten quarries as they are needed.

Office of Bloomington Crushed Stone Company

The single bench method is used, the entire face being worked. Two ledges are being operated, one on the north and one on the south end. The walls at both ends are about 50 feet thick.

Atlas 60 per cent gelatine dynamite is used for both ledge shots and for breaking up the larger pieces of stone. This work is under the direct supervision of an experienced explosives man. The dynamite is kept in a 10 by 10 foot frame house on concrete base, on a hillside by the quarry. This house is kept securely locked at all times, only the explosives foreman having a key. He loads the dynamite into a small hand cart and hauls it to the ledge. Here the paper covering is removed and the dynamite slipped into the hole and tamped. Detonators of different lengths are used, depending upon the depth of the holes. For igniting the detonators, a direct current switch located near the crusher house is used.

Large shots are usually placed in the evening just after the men have quit work, although sometimes the noon hour is utilized for this work. To break up the large chunks, plug shots are used when they have time to use the small jack hammer drill, although frequently "dobe" shots are used, especially during the noon hour, when they are pressed for time. The advantage of a plug shot is

Result of Blast in Quarry

that it requires a stick only about three inches long, while with a "dobe" shot it takes from six to nine inches to break up the same size stone. Hand sledges are used to break up the smaller pieces.

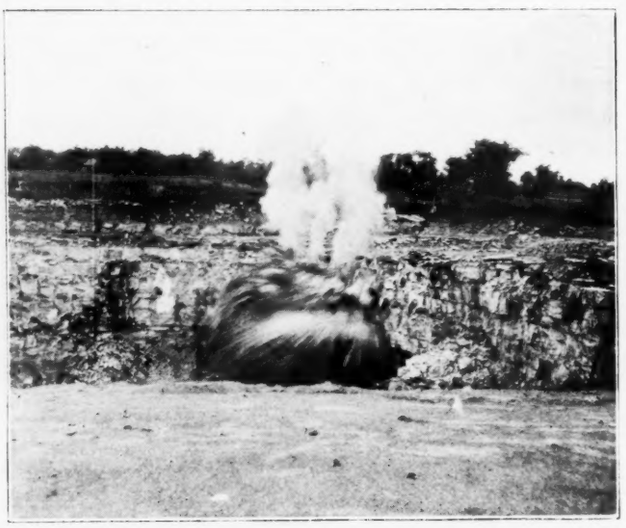
In the shot shown in the accompanying photograph, there were nine holes, 1¼ inches in diameter and 12 feet deep. A total of about 70 pounds of dynamite was used, and approximately 300 tons of rock was displaced. This was a rather small shot, the quarry foreman explained, most of them running from 12 to 20 holes. When running full capacity, shots are placed every other day, alternating with the ledges. One shot of 20 holes, 14 feet deep, displacing 800 tons, will supply enough stone for about four days' run on each of the ledges. The cost of the broken stone delivered to the crusher is about six cents a ton.

Each ledge has the same size crew under a foreman, seven breakers and loaders and a boy to lead the mules. The broken stone is loaded by hand into end dump carts holding ¾ yards, then hauled to the foot of the incline track leading to the crusher house, where it is dumped into an Austin two-yard steel end dump car in an underground pit. The loaded car is pulled up a 300-foot incline by an electric drive hoist with ¾-inch Mac White cables and automatically dumped into the crusher.

View of Crusher House and Mixing Plant

Two crushers are used, a Symons number 8 cone crusher, and an Austin number 6 gyratory crusher. The former was placed in service only this spring. It has a capacity of 50 tons an hour. The Austin crusher has a capacity of 60 tons an hour. Both crushers are operated by individual motors from power supplied by the Interstate Public Service Company.

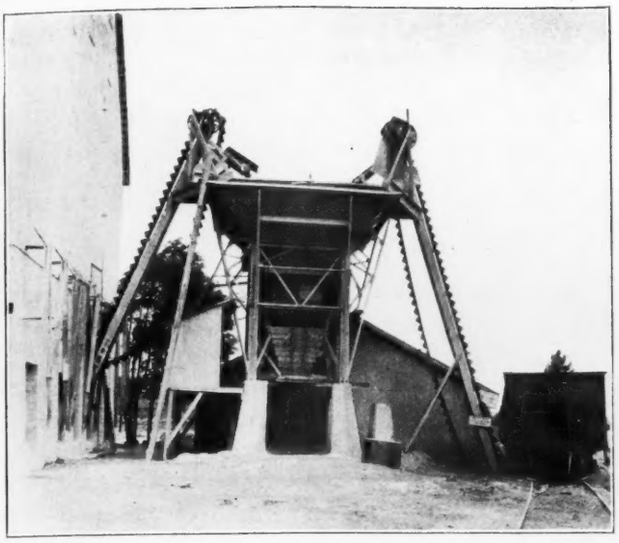
The material is graded by a vibrator screen, made by the W. S. Tyler Company, and is a recent installation. A 30 foot Austin rotary screen, 48 inches in diameter, with four sections and a dust jacket also is used. Any size material in current demand will be furnished, although four grades of crushed rock and one of screenings make up the usual run, these being screened automatically and carried by chute to the proper bin. These are 1, 1¼, 1½, and 1⅞-inch. Coarse material is caught by the screens and returned to the crusher where it is recrushed.



A Small Blast in Quarry

Storage is provided by eight bins, each holding 250 tons, providing a total storage capacity of 2,000 tons. These bins are built of concrete and frame, covered with galvanized iron. The concrete used in the construction of these bins consisted entirely of portland cement and limestone, crushed stone being used for the coarse, and screenings for the fine aggregate. The mix used was 1:2:3.

The average daily production of this plant is about 400 tons of crushed rock and screenings, of which approximately 60 per cent is used for concrete roads and other concrete work, 35 per cent for macadam roads and five per cent for agriculture. Formerly the entire output was used for macadam road construction, the coarse material being used



Concrete Mixing Plant

Dump Car and Incline

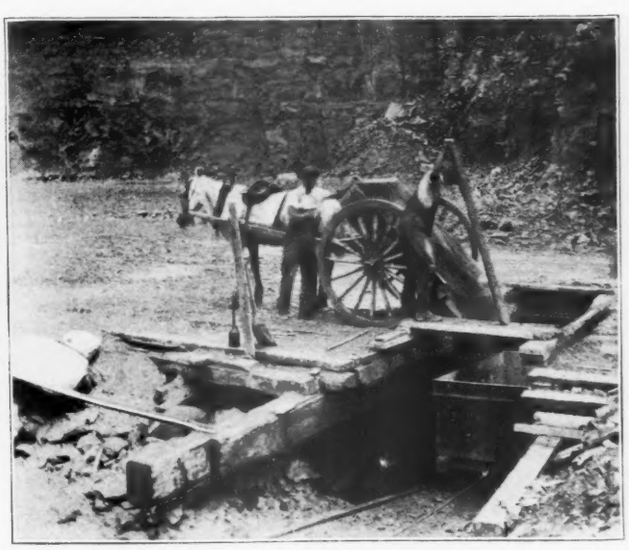
for the foundation and screenings for the top dressing. But with the advent of concrete, the old macadam roads are falling into disfavor, and the demand for aggregate for concrete roads is steadily growing. Very little of this material is shipped because of the excessive freight rates and the competition offered by gravel and other crushed stone over the state.

Screenings are produced by catching the finer material in a 3/16-inch dust jacket. About 40 tons are produced daily, of which about 80 per cent is used locally and 20 per cent shipped. Much of it is used for covering coarser crushed rock in macadam roads and for concrete aggregate. A rather rough estimate is that about half of it is used for this purpose and the other half for agriculture.

The company does very little delivering, practically all sales being made f.o.b. the plant. Three trucks are owned and maintained for emergency use. A delivery service formerly was maintained and deliveries were made anywhere on a basis of 20 cents a yard per mile, most of them being within a 12 mile radius of the plant. Also a ready mix and wet mix concrete department was maintained. Both dry and wet mix was delivered on the same basis as crushed rock, within about the same radius. For this service, sand shipped in by the Illinois Central railroad was used. This was sold at $10 a yard for a 1:2:4 mix, plus delivery charges. All stone aggregate, substituting screenings for sand, also was sold at a slightly lower rate if desired.

The wet mix service never progressed beyond the experimental stage and was discontinued some time ago because of the difficulties caused by settling of the cement. Delivery service on dry mix and crushed stone lasted somewhat longer, but it was found that contractors preferred to do their own hauling, and later the dry mix was entirely taken over, and the necessity for delivery was further obviated by the establishment of a ready mix

Loading Stone in Dump Cart



Unloading Dump Cart in Underground Pit

service supplied by a central mixing plant owned and operated by U. R. Price and Company.

Crushed stone and screenings are sold to this concern at the bin. It mixes and supplies concrete ready for the paver for street contractors, also other concrete work in and around Bloomington. A Blaw Knox central mixing plant with 50-yard capacity is used. Crushed stone for coarse and sand for fine aggregate is used, the sand being shipped in by the Illinois Central railroad. All-stone concrete also is supplied if desired, and it has been used successfully in and around Bloomington for some years. But because it has not been a success in all cases, the use of this mixture is not recommended.

More Than 28,000 Miles of State Roads To Be Constructed by States in 1928

Forty-five state highway departments will construct 28,538 miles of good roads during 1928. Both states and counties are now in the midst of the most elaborate road construction program in history, it is stated.

Three states have not reported their official programs. They are Connecticut, Virginia and West Virginia. It is believed that these three states will add at least 1,000 miles to the year's state highway program. The number of miles of road under construction on the county system is not known.

Expenditures during the year will total approximately $1,307,821,000 in the 46 states reporting their estimated appropriations for both county and state work. Connecticut and West Virginia did not report. The total expenditures during 1927 for all states was $1,123,607,055, or $184,216,661 less than will be expended in 46 states during 1928.

"Not only has the good roads movement expanded considerably during the present year," the American Road Builders' Association states, "but the work which is being done is much better and much greater than ever before. This is the result of more scientific construction and maintenance methods and improved road building machinery and equipment.

"Thorough studies of road building and maintenance methods have greatly reduced the costs of good roads. The annual convention and road show of the American Road Builders' Association which will be held in Cleveland next January is expected to bring to light many new scientific improvements destined to decrease construction costs and increase efficiency even more than during the present year."

The association pointed out that the cost of good roads this year will be less than eight-tenths of one cent for each mile traveled by motor vehicles, and that a good road saves from 2 to 3 cents per mile in cost of vehicle operation.

Utilization of Anhydrite in Cement Retardation

There is a wide variation in the physical properties of anhydrite as it occurs in nature, and since only one sample of anhydrite was utilized by the United States Bureau of Mines in its former investigation concerning the action of anhydrite as a retarder for Portland cement, the Bureau was urged to conduct further work to determine whether the type of anhydrite or its degree of fineness might not have an appreciable effect upon its action as a retarder. The tests which were originally outlined to cover this problem have been practically completed.

The information obtained so far seems to justify the following tentative conclusions:

It is practically essential that the clinker and retarder be ground together if consistent results are to be obtained in any investigation of this type.

The type of anhydrite has no marked relation to its action as a retarder, but the fineness of the retarder is of considerable importance, particularly as regards its effect upon the plasticity of the cement.

If the cement is properly retarded all forms of calcium sulphate will produce practically the same quality of cement.

While cement of good quality has been obtained by using anhydrite as a retarder, the variation in the properties of the cement clinker itself makes it essential that information be obtained concerning the retarding action of calcium sulphate before stating definitely which form, if any, is the most efficient retarder for Portland cement clinker.

Cement in June

The ratio of the operations to the capacity of the American portland cement industry during the month of June was 90.1 per cent, according to figures released July 12 by the Bureau of Mines of the Department of Commerce. During the month 17,469,000 barrels were produced, 18,421,000 barrels were shipped, and there were in stocks on hand at the end of the month 25,021,000 barrels. Production in June, 1928, was 1.4 per cent more, and shipments 6.8 per cent less than in June, 1927. Stocks at the mills were 19.3 per cent higher than a year ago.

THE AGSTONE INDUSTRY FROM A RAILROAD STANDPOINT

By E. J. Leenhouts
General Agricultural Agent, New York Central Railroad*

YOU will be relieved to know that there are several phases of the agstone subject which I propose to leave out of this discussion—phases which usually occupy prominent places when I am called upon to discuss this subject. The first of these is the merits of the material in increasing crop productions. I will just pass that off by saying that it is the biggest single factor in more efficient crop production where good agricultural land is involved. This goes unchallenged at all agricultural meetings, the advocates of good seed being the only ones who could put up an argument.

The second phase which I intend to pass over very lightly is the question box regarding fineness of material, rate and time of application, mode of testing for acidity, etc. In fact, all I will say about that subject is that those territories which a few years ago insisted on very coarse material are now swinging to the other extreme, while the territory which insisted on the finely pulverized material is swinging to the coarsely ground material. It is very likely that they will settle on a medium fine material which will take care of the immediate needs of the soil and, at the same time, have a large percentage of material which will carry over without leaching out of the soil. Incidentally, out of this theory is developing the question as to the frequency and quantity of application, much or often, the effect of very fine material on other food elements when applied to nearly neutral soil, etc. These questions can be safely left to our state college.

The question which interests you and which interests me, as a transportation man, is that of "How can we increase the use of limestone" and that is what I would like to discuss. Any suggestions which I will have to offer will be based largely on our own experiences, and so I am going to give you a short history of the limestone campaigns which we have conducted in cooperation with several of your members and with the state universities.

Convinced that the greater use of limestone was the key to greater farm efficiency and that its increased use would be reflected back to us as a transportation agency in (1) revenue on limestone handled, in (2) revenue on increased farm produce and (3) our pro rata share of the farmer-patron's increased prosperity, we launched a strong agstone campaign in 1921 in cooperation with several of your concerns and the state universities. We first distributed posters throughout the territory calling attention to the merits of limestone. Then we made arrangements with agstone companies like the France Stone Company, Solvey Process Company, Ohio Marble Company, Marble Cliff Quarries Company, Colgan Limestone Products Company, Carbon Limestone Company, Ohio and Indiana Stone Company, Lehigh Stone Company, Campbell Limestone Company, etc., whereby they donated material to us and we transported the same to various counties in our territory. Here we had previously arranged, through the county agent or some other representative of the state university, for a series of about twenty demonstrations on as many farms, two to four tons to a farmer. By this system, 600 separate demonstrations on the use of agstone were established on as many farms throughout our territory and almost all of the farmers still in need of this missionary work were reached. Following this up with tours and meetings covering these demonstrations, we feel that they formed a necessary step in the process of convincing the average farmer.

In 1924, we decided to carry the message still further through the operation of soil fertility trains to cooperation with state universities. A series of these were operated, two in Ohio and three in Michigan, covering different sections of our territory until every important section was reached. Over 20,000 farmers visited these trains and 6,000 samples of soil were tested. The results from the demonstrations were presented in charts and lectures. These trains drove home the message of agstone and must have had a great influence on the increased popularity of limestone because a summary made in 1925 showed that the limestone shipments into points reached by our Michigan Soil Fertility Train in 1924 showed an increase of sixty-four per cent over the previous year, whereas the general increase in the rest of our territory was only eleven per cent.

Here are the general results to date: First, a questionnaire sent to our Michigan farmers who conducted the 246 demonstrations in that State, revealed the fact that where seventy-four admitted definite benefits, only thirty-three per cent had since put in an order for limestone. Sixty-two per cent of them confessed, however, that one or more of their neighbors had noted the demonstrations and purchased a carload or more for their

*Presented before the National Agstone Association at West Baden, January 28, 1928.

own farms. Hence, we are safe in saying that these demonstrations were at least sixty-two per cent successful in creating a bigger market for limestone.

Second, the record of carloads of limestone delivered to our points in Michigan, Ohio, Indiana and Illinois, shows that we were handling better than three cars in 1926 against one in 1922. Third, take the Michigan record as an example, because the limestone business in that State was hardly started until 1920 and, therefore, these missionary efforts should be credited with the increases during the past five years, 80,000 less tons would have been sold by you in our territory, and 80,000 less tons would have been handled by us, if the demand had remained unchanged during the past five years. The Michigan State College has ascertained after ten years of experimental work, that a ton of limestone will give a net return of at least twenty-five dollars in ten years. This means a million additional wealth in the pockets of our farmer patron. Some of this was re-invested in limestone which gave joy to our salesmen. Most of it was used in such a way that everyone in the community, including the railroad, was benefited thereby.

Now let me emphasize that we, as a railroad, do not claim credit for all of this development in the use of limestone. We played our part, I hope, in a campaign which involved the coordinated efforts of your limestone companies, the state colleges, and the progressive farmers. Together we put across a campaign which was intended to convince the farmer that the use of limestone pays and to show him how best to apply it, the "why" and the "how."

So far I have talked largely about what we have done and I will very likely continue by telling you what we propose to do. All of it, however, is so closely linked up with the thing which you all want to bring about that I am sure you will pardon me. From now on it is a question of selling limestone—selling. Make the farmer want it so badly that he cannot sleep until he gets it. That, of course, is the secret of salesmanship, and we certainly need salesmanship in this agstone business. How are you and I going about it? First, put and keep quality in your product. Keep those big chunks out which roll in from your other bins and later raise the dickens with the farmer's spreader and temper. The trade demands quality all the way through. There are a dozen other ways in which the quality can be safeguarded.

The second thing that has to be kept in mind at all times is the matter of service. Get an up-to-date local agent who appreciates the value of the little things that get business. If the community needs a limestone bin, see that they get one, preferably through local cash. Stand back of your material but plan on making it so good that there cannot possibly be any kick back.

The third essential is a stronger selling campaign. Get your local agent to do some active soliciting for orders—most of them are simply taking orders (milking-machine salesmen). Join hands with other forces interested in the increased use of limestone, such as the state universities, county agents, soil improvement associations, railroads, etc. Nothing quite equals an organized campaign, with organized publicity back of it, in putting across an idea. Make the farmer want the material—if he really wants it, he will find a way to get it, weather, finances, distances, etc., notwithstanding.

You may be interested to know that we are working on a plan whereby we will put on in one county in each of our States a strong concerted campaign for a greater legume acreage. The business men will be organized into committees, a series of meetings will be held, a club will be formed, special editions of the local press will be used, numerous outside agencies such as the Blue Valley Creamery Institute, will cooperate, etc. An organized drive with organized publicity, to sell alfalfa and, as far as we are concerned primarily to sell limestone. Our men in each of these States will be calling on you or your representatives in these various territories and I am sure you will be ready to make suggestions as to the limestone phase of such a campaign and also help to carry it through. This campaign will last about six weeks and it might be to your advantage to offer a special price for that period. Also, your local agents should find it to their best interests to carry special advertising during that time.

Flotation of Lowgrade Phosphate Ores

The study of the flotation of low-grade phosphate ores, now under way at the Southern Experiment Station of the United States Bureau of Mines, Department of Commerce, indicates that flotation has possibilities not only for ground material but also for unground sands minus 20-mesh in size. Though concordant results have not been obtained in all tests, the separations obtained are believed to be indicative. In several tests on unground sands recoveries of from 90 to 95 per cent of the phosphate have been obtained with concentrates that are of commercial grade or can be made so by a single cleaning treatment. Reagent consumption has been decreased somewhat from the amounts required in the early work. No reagent combinations other than those based on oleic acid, sodium oleate, or soaps containing considerable amounts of sodium oleate have been found that effect a separation between the phosphate and quartz.

HOW TO SPLICE WIRE ROPE

By Oscar Hellgren
Wire Rope Splicer, East Chicago Plant, Youngstown Sheet and Tube Company

PERHAPS the first principle that should be set forth in a paper on this subject is: Do not splice worn ropes. Any service that might be obtained from a spliced worn rope will not be worth the trouble and expense of splicing, to say nothing of the increased hazard to workmen through the operation of an unreliable rope.

The tools needed for splicing wire rope are simple and few, being:

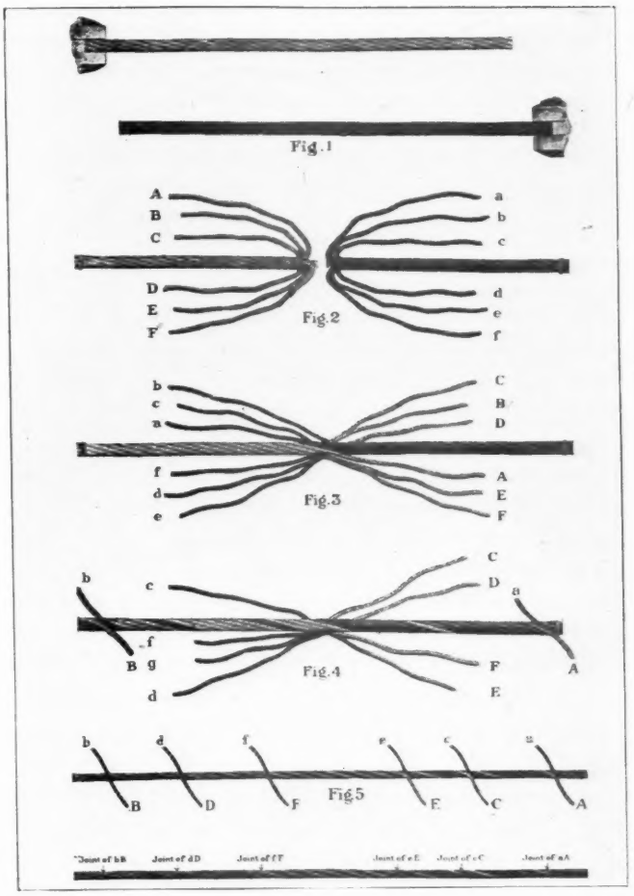
1—14″ or 16″ Carew cutter, heavy nipper type
1—12″ tapered Marline spike of tempered steel, 1″ thick at the heavy end and with a flat thin point
1—7″ tapered spike of tempered steel with ground handle. This may be made of a ⅜″ round "rattail" file annealed and ground smooth with point flattened, then retempered
1—Medium sized, portable vise
1—Short bladed, sharp pointed knife
1—Small bar, or lever, of wood (hickory)
6 feet of ½″ hemp rope for a sling
Small quantity of soft wire and a roll of electrician's tape.

This set of tools will apply to the splicing of rope 1″ or smaller in diameter. Larger diameter ropes require no more tools; merely the same as those listed above, only heavier.

As a guide to the proper amount of extra rope needed for "long" or "endless" splicing of 6x19 construction, the following table is given:

Rope Diameter Inches	Footage Allowed for Splicing, Feet
⅜	15
½	15
⅝	20
¾	24
⅞	28
1	32
1⅛	36
1¼	40
1½	45

The accompanying illustration, taken from the U. S. Bureau of Standards, shows the progressive steps involved in splicing wire rope. Because there is so much that is not told in this illustration, however, a typical job of splicing will be described, using as the example a ¾ inch, 6x19 preformed wire rope.



As indicated above, the extra cable required for a splice of this kind is 24 feet. This means that 12 feet of each rope end will be devoted to the work of splicing. These two 12 foot ends are prepared exactly alike. In the example cited no tie wires are necessary because preformed wire rope lies flat and will not fly apart when cut. With ordinary wire rope it would be necessary to tightly seize each rope 12 feet from the end, then in addition, apply a temporary tie wire about one foot from the rope ends to permit seizing the individual strands as they are unlaid.

In the example set up, however, it is merely necessary to unlay the six strands to a depth of 12 feet and, after cutting away the hemp core, place the two unlaid ends together, with the strands alternating as shown in Figures 2 and 3.

First Lay Most Important

The next step in splicing rope is to do what is shown as having been done in Figure 4, viz: to unlay one strand and lay in the corresponding strand from the opposing rope. This is perhaps the most important step in making a good splice. Ordinary rope, more particularly than preformed rope, has a tendency to twist, thereby refusing to permit the first strand to conform exactly to groove

left by the unlaid strand. Wherever this is noted (very rare with the preformed type of rope due to the preshaped characteristic of each strand) the work of laying in the strand should be stopped and an adjustment made in the way the two unlaid ends (See Figure 2) butt together.

With the first lay properly adjusted and laid in, all successive strands will fit easily and readily into their correct position. Constant care should be exercised, however, to see that each strand does not in any way untwist or lose the helical curve that was given it at the time of the rope's manufacture. It is very poor practice to unlay one strand far ahead of the strand being laid in. Rather, strand "a" should be unlaid only as rapidly as strand "A" is laid in—both operations proceeding together—slowly, carefully and with constant pressing and adjustments that will make the inserted strand fit perfectly into the groove left by the unlaid strand. The first strand is laid to within one foot of its full length, after which the strand just removed is cut away, save for a 12-inch length. Tie these two one-foot lengths together and to the rope with a ravel from the hemp center. This is necessary to prevent the strands unwinding while the rope is being handled for the remaining strands.

After the first strand has been laid into each end, proceed with successive strands, stopping each lay about 30 inches from the point where the previous strand was stopped. This 30 inch spacing of strand ends is recommended for ¾ inch rope. Naturally, the spacing and length of ends will vary proportionately with the different sizes of rope. This will give, in the end, a rope that will have an appearance similar to Figure 5.

Tucking in the Ends

Before starting the final steps of tucking the 12 ends into the center of the rope, wrap each strand end with electrician's tape. This wrapping will serve a double purpose. It will increase the diameter of the strand to the same size as the hemp center it replaces, and will act as a cushion that will prevent internal wear against the overlying strands. If adhesive tape is not available the strand ends may be tightly wrapped with ravelings from the discarded hemp center.

It is also advisable, as a preparatory measure, to bend the 12-inch end of each strand back sharply upon itself thereby creating a kink in the strand close to the rope at the point where the strand ends have been crossed. In addition to kinking, untwist the strand at this point until it is quite flat and the 19 quires in the strand have been separated. When this kink has been partly straightened back the strand end may be tucked into the center of the rope in the same direction as it is laid and will allow the strand end to taper away from each other at the point of tuck, thereby preventing any bulge or enlargement of diameter in the finished rope. Also, when properly done, this form of tapered, kinked end, prevents the tucks from creeping.

In the actual work of tucking the strands securely, place the cable in a wise as indicated in Figure 2. Now fasten the hemp sling and lever around the cable in such a way as to open the rope when leverage is applied. Once the rope has been twisted open, insert the short spike under two or three strands. Now insert the large spike right alongside the smaller one. Rotating this large spike will further open the rope, after which the small spike may be used to pick out the hemp center for cutting.

Having cut the hemp center and pulled out the ends, insert the large spike still further into the rope. Now work into the center of the rope the strand ends, trimming the hemp center flush with the strand end. Care should be exercised to remove no more hemp than is absolutely necessary.

The large spike may now be replaced with the smaller one which is used to hold the strand end and hemp in place while the lever is released and the rope closed. After carefully removing the small spike the last operation is to flex the rope with the hands to compel both center and outside strands to fit into their assigned positions.

So much wire rope is in use by practically every industry that nearly every industrial company should have in its employ at least one good mechanic who is qualified to do this work. It may be learned and performed by any mechanically minded workman but, of course, practice and care are necessary to make a good, dependable splice. It will be found in actual splicing practice that the preformed type of rope will handle much easier than the ordinary type of rope. Indeed, a splice that will require 8 hours of one man's time with ordinary wire rope, can ordinarily be completed with preformed wire rope in about 5 hours. Such a reduction in splicer's time (which is due to the more flexible, less "cranky" characteristics of preformed rope) is entirely dependant, however, on the individual splicer's skill.

Current prices for labor for splicing wire rope endless are about as follows:

Less than	½" diameter ropes	$3.50 to	$5.00
	⅝" diameter ropes	4.00 to	6.00
	¾" diameter ropes	4.50 to	7.00
	⅞" diameter ropes	5.00 to	7.50
	1 " diameter ropes	5.00 to	8.00
	1¼" diameter ropes	6.00 to	9.00
	1½" diameter ropes	10.00 to	12.00

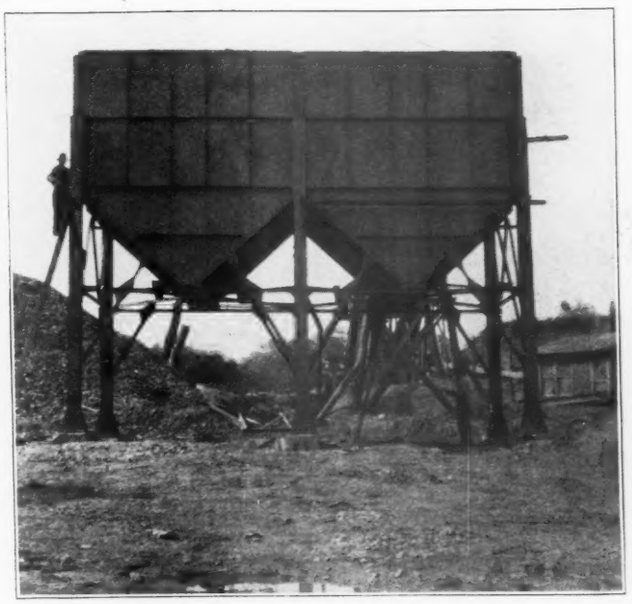
These labor prices will, of course, vary with geographical location and local labor conditions and cover labor charges only. The figures do not include the additional 15 or 45 feet of rope required, necessary tools, or other costs.

LIVINGSTON SAND AND GRAVEL COMPANY PROFITS BY EXPERIENCE

EXPERIENCE can often be turned to profit. This is generally true if the mistake is something of a lesson in avoiding the repetition of the mistake. The profit comes in saving a second such loss. This is demonstrated in the case of the Livingston Sand and Gravel Company of Livingston, New Jersey. This company recently suffered a loss through the collapse of its wooden bins. The danger of collapse was very probably pointed out more than once. The mistake might have been made in not heeding the danger or it might have been made in the original plant. However, the wooden bins collapsed and the Livingston Sand and Gravel Company rebuilt, but profited by experience and put in permanent bins. In this case the bins are substantial steel units manufactured by the Butler Bin Company, of Waukesha, Wisconsin.

The property of the Livingston Sand and Gravel Company was purchased on June 1, 1927. It consists of forty-nine acres situated on Mt. Pleasant Avenue in the town of Livingston. The plant is only six miles over good roads from Newark, New Jersey.

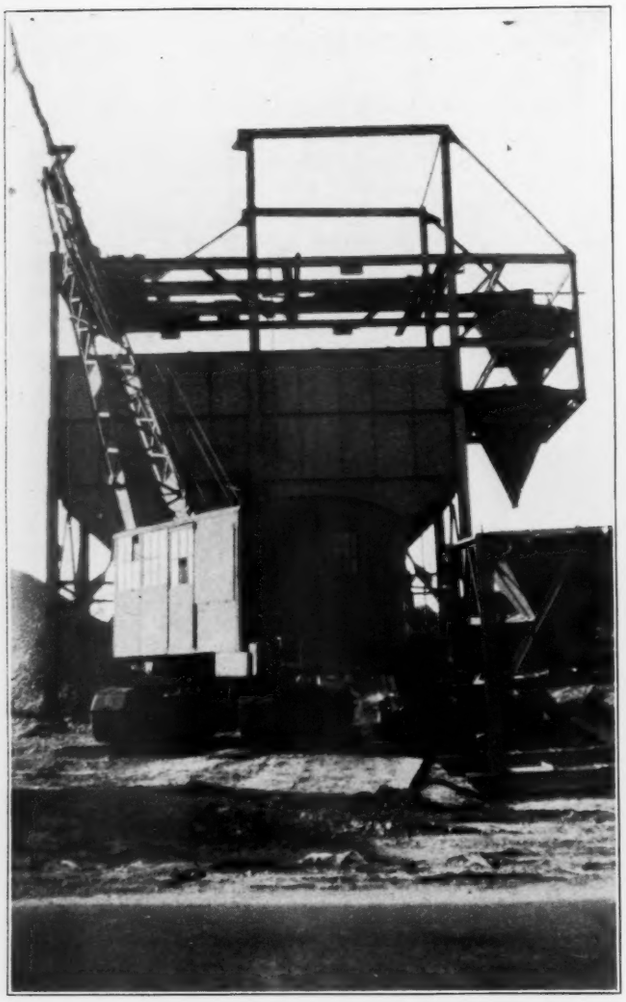
Operations were started on July 8, 1927. A Seuerman dragline operated by a Munday hoist brings the material into the plant. Smith Engineering screens separate the different sizes. The sand is handled by Allen Cone tanks. A Worthington centrifugal pump supplies the water from a reservoir which is fed by a brook on the property.



First Half of the New Plant

On December 4, 1927, the plant had four wooden bins in use. The plant ran along until May 1, 1928, when the wood bins which were built in one unit collapsed. It appears that the collapse was due to emptying the center gravel bin allowing the outside bins to cave in. On May 4, 1928, the company

Photograph Taken Ten Minutes After the Plant Caved In



Handling the First Bin Shipment

Showing Bin Under Construction

Cleaning the Old Plant Away

Installing te Sand Cone

engineer started for Milwaukee to see the Butler Bin Company and Smith Engineering Works. A new set of Butler Bins were purchased with the superstructure for Smith screens, Smith scrubber and Allen tanks. The bins were received on May 22, 1928 and erection started immediately. Operations were resumed and shipments made on July 1, 1928 and at the present time the plant is running at full capacity without danger from the bins collapsing. A lesson from experience has been turned to profit. The occurrence of the same mistake has been prevented.

(Continued from page 64)

injurious effect on the oil, and it is not subject to any change as the result of exterior conditions. Amorphous graphite is not as well suited for paint as the crystalline form, because of its earthy impurities. The laminated crystalline form is best.

Crystalline graphite is used for polishing the bottoms of racing craft. Amorphous graphite is used as a body for holding the dye in the manufacture of felt hats, and as a means of connecting the filament to the platinum wires in incandescent lamps. Mixed with a nonconducting binder it is formed into rod and plate resistance units. It is also used as a substitute for red lead in threaded joints and gaskets.

Graphite produced in the electric furnace has the gray color and lustre of the natural crystalline form, but lacks the same smoothness and softness when pulverized. This process is employed for the graphitization of electrodes and brushes. Graphite has a specific gravity of 2.26, a hardness of 1 and a valency of 4. It is the only stable form of carbon at high temperature, all others passing into it when heated.

Potash Found in New Canadian Rock Salt Discovery

The Department of Mines at Ottawa, Canada, has made an announcement that potash salts have been discovered in a thick bed of rock salt which was being bored in search of oil and gas at Gautreau village, Westmoreland County, New Brunswick. The deposit is located in the belt that runs along the Northumberland Straits littoral in which the Malagash deposits lie. The general opinion is that if potash can be found in commercial quantities in the two provinces of Nova Scotia and New Brunswick, the Canadian Maritimes will have an industry of great value to the British Empire. The drilling operations at Gautreau were conducted by the D'Arcy Exploration Company on behalf of the New Brunswick Gas and Oil Fields, Limited. At 1,295 feet from the surface the drill entered a bed of rock salt 485 feet thick. Samples selected for analysis in the laboratories of the Mines Department of Ottawa have been found to contain a varying percentage of potassium, and this element is present in each sample tested.

Changes Taking Place in Kaolin

After a review of the literature, K. concludes: (1) that the H_2O is removed from kaolinite at or above 430 + 10 degrees, the major part of the H_2O of constitution being more completely and quickly removed with lower vapor tension and less completely and more slowly with normal vapor tension; (2) that the dehydrated kaolinite cannot be considered as an ordinary mechanical mixture of Al_2O_3 and SiO_2, but that there is some systematic bond between the two oxides, perhaps a lamellar variation of the original structure skeleton although x-rays fail to show a true crystal lattice; (3) that the cause of the exothermic reaction near 900 degrees during the heating of the kaolin is still not fully explained; (4) that mullite is probably only stable at high temperatures and that further work is needed to determine the nature of the products of decomposition of mullite on cooling. K. Spangenberg. (Keram. Rundschau *35*, p. 331-6, 352-4, 370-2; 1927). C. A.

Huge Auto Tax Refund Coming

Approximately $10,500,000 will be refunded to the 53,125 automobile dealers of the country, as the result of the elimination of the three per cent automotive excise tax, which went into effect May 29th, according to figures of the American Motorists' Association.

This amount is based on figures just announced by the Treasury Department, showing that when the tax was reduced from five to three per cent on passenger cars on March 28, 1928, the dealers of the country obtained a refund of $7,534,813.59.

The department's figures show that the dealer keeps in stock, for demonstration and display purposes, an average of approximately 7.7 new automobiles. Also, that his complete inventory shows 200 different items he stocks to supply his trade. When the tax was reduced from five to three per cent, the 55,445 dealers in business at midnight on March 28, 1926, had the following inventory on their floors:

Completed automobiles	430,259
Automobile bodies	323
Automobile chassis	406
Motorcycles	913
	431,901

The figures compiled by the Association show that Pennsylvania, with a total of 4,035, has the largest number of automobile dealers of any one state. Other leading states in the order named, are New York, 4,000; Ohio, 3,394; Illinois, 3,329; California, 2,504; Wisconsin, 2,381 and Michigan 2,227. Delaware with a total of 87 and the District of Columbia with a total of 90, report the smallest number of automobile dealers.

In addition to the 53,125 dealers in the country, there are approximately 90,000 service stations and repair shops. This means that for every repair shop there is an average of 261 passenger cars and trucks.

Fused Aluminous Cement

A rotary kiln is used, in which the preheating zone is so short that the raw slip enters the zone of maximum temperature, of 1600-1700 degrees C., still containing a considerable quantity of carbonate, as the calcination and dehydration are endothermic reactions, the temperature of the slip in the preheating zone is prevented from going over 1000 degrees C. Another advantage is that rings destructive to the kiln cannot be formed at this comparatively low temperature, while on the other hand, when the slip enters the fusion zone the temperature here is too hot to permit ring formations. Soc. An. Ciments Francaise, etc. (German Patent 459,041).

W. J. Mathews Says

"Every industry, in order to prosper, must be regarded as an entirety. Business men must choose between individualism, on the one hand, and cooperation on the other. Desires and aggressiveness to acquire volume and yet not demoralize or disturb market conditions generally is the most important thing calling for solution on the part of business executives. The phrase "Profitless Prosperity" has recently gained considerable currency. It is the duty of business executives to render an essential public service by "pulling the teeth" out of that slogan and seeing to it that we have prosperity resulting from a reasonable volume of business without dwindling profits.

"It is rather an unusual situation for a reasonable volume of business to be moving, and yet profits, if any, grossly inadequate. The reason is not far to seek. The cause for such a condition is either personal aggrandizement or the fallacious policy of taking orders with no thought or consideration of capital invested and costs, and with no regard to the question of reasonable profits. Insistence upon running a plant at approximate capacity, even though at a loss, is getting to be all too common an occurrence. Individual sovereignty and common welfare—individualism or cooperation—are proper topics for discussion and consideration in connection with these questions, and especially the question of reconciliation of volume with reasonable profits.

"It is an erroneous notion that sales managers are employed primarily to sell goods. As a matter of fact, any one can sell an article if the price is low enough. The sales manager is employed to sell goods at prices which will net a reasonable profit. The efficiency of the sales manager declines with the lessening of profits."

October 3 to 6, 1928, is the date set for the National Highway Congress to be held in Mexico City. The Congress has been organized under the auspices of the Mexican National Highway Commission. An exposition of road building machinery will be held in connection with the Congress, and demonstration of modern highway construction methods will be given. It is expected that the various Mexican states will be represented at this Congress. The officers of the Congress are: President, Ing. Ignacio Avilez; Directors, Senors A. Gloria, G. Johnes, R. Padilla, J. G. Hernandez and Ing. Jose Rivera R. Secretary, Sr. Juan F. Acosta, whose address is Calle Nuevo Mexico No. 90, Mexico, D. F. It is anticipated that machinery and material shipped from the United States for display in the exhibition will be permitted to enter Mexico duty free under bond, and that a reduction in freight rates will be made.

PENSION SYSTEMS

Part One

ONE OF the most complicated problems confronting industrial employers at present is that of the pension system. Few of the industrial pension plans in the United States today are so financed that they are likely to remain solvent without refinancing or modification.

In the case of many municipal and other public service pension plans, failure to count the cost carefully has already resulted in bankruptcy of the pension systems, either actual or constructive. Indeed, it is hardly too much to say that the history of pension schemes has been a record of mistakes or failures. Even the elaborate Carnegie Foundation plan was forced to undergo a radical reorganization only a few years after it was started.

Before taking up the question how a pension system shall be established, it is imperative to consider whether it should be established at all. Until a satisfactory answer can be given to the latter question there is little occasion to discuss the question of method.

Broad Object of Pension Systems

Among the more important motives which lead industrial employers to adopt pension systems are:

(a) A desire to provide for the old age of dependent, superannuated employees.

(b) A desire to reward employees who have rendered unusually long service.

(c) A desire to increase efficiency, first, by the elimination of superannuated or incapacitated workers on a humane basis and, second, by stimulating the good will and effort of the active force.

(d) A desire to hold the worker on the job, thereby reducing labor turnover.

(e) A desire to exercise a disciplinary control over workers in respect to strikes and in other ways.

In some pension plans all of these motives are present; in others, only a portion. The broad objects of pension systems, as above enumerated, will now be examined.

Pensions as a Means of Providing for Dependent and Superannuated Workers

A large number, perhaps a large proportion, of industrial workers either cannot or do not make adequate provision for their old age. When such workers reach a stage of superannuation the employer is forced with the alternative of throwing them back on society, with the knowledge that they will become objects of charity, or of himself making some provision for their remaining years. This practical fact has been an important and probably the controlling consideration in the establishment of industrial pension systems of the day. From humanitarian motives, the employer is not content summarily to dismiss such superannuated workers after long years of service. Moreover, he often hesitates to do this, on the practical ground that such a policy may have an unfavorable reaction upon the larger body of employees still continuing in the service.

Pensions as a Reward for Long Service

The conception of pensions as a reward for service takes no account of the necessities of the workers, but, ostensibly at least, pensions alike all, whether self-supporting or dependent, who have rendered a given length of service to the establishment or who have fulfilled certain prescribed conditions. Furthermore, it does not necessarily require continuance in service until the employee actually is superannuated. Under many plans an employee who commences work at an early age may retire on pension before he can really be termed old if he has served the required number of years.

As a straight reward of service most pension systems are grossly inadequate. The percentage of workers who go on the pension roll usually is only a small fraction of the total force, or even of those remaining with a company for long periods. Often times it is almost negligible. Moreover, such systems become highly inequitable as between individual workers. An employee who happens to have completed, say, twenty or twenty-five years of service may get a pension, which may be thousands of dollars, while another worker, perhaps more efficient and more faithful, but who has just failed of completing the required period of service, may get absolutely nothing. If long service is entitled to a reward, then it would seem that a system which pays a large benefit for, say, twenty years' service, but pays nothing for nineteen years' service, is inherently defective.

A further objection often advanced against the "reward-of-service" idea, as actually operative in many pension plans, is that it may put a premium on inefficiency by keeping men in service, the retirement of whom should be the primary purpose of a pension system. For example, a humane executive may be tempted to retain on his force a worker who needs only one or two more years of service to entitle him to a pension, even though the worker has become distinctly inefficient. Paradoxical as it may be, a pension system may thus defeat what is perhaps its most important aim. On the other hand, a heartless factory executive may

dismiss an efficient man approaching the retirement age, in order to save the company the cost of maintaining him later on pension.

Still again, it has happened that where the cost of pensions was rapidly mounting, the terms of the plan itself have been changed, with the result that many workers have been deprived of the pension benefit to which they have been looking forward.

Pensions for Increasing Efficiency

This is one of the primary motives which have led to the establishment of pension systems. A pension system, it is urged, tends to relieve the employer of any compunction which he may feel over the dismissal of a worker grown old in his service and now without means, and thus more readily enables him to increase the efficiency of his working force by weeding out those no longer able to perform their allotted tasks. The "drag" of such workers upon production is well known to all industrial executives. It is extremely wasteful to permit a superannuated worker to continue at a task where his inefficiency means a lower output not only for himself, but for all others associated with him in the operation. In some cases, notably in work of a "line" character, it is imperative that such a worker shall not be retained, at least in the particular position. Many establishments have endeavored to meet this difficulty by finding other tasks of a lighter or less exacting character, to which such older workers are assigned. But the oportunities of this sort often are far too few to take care of the increasing number of superannuated workers. The employer has, therefore, resorted to the expedient of a pension system in order to enable him to dismiss such workers without raising any question of injustice or of adverse reaction on the other employees.

Pensions as a Means of Increasing Efficiency

This is also one of the primary motives which have led to the establishment of pension systems. In distinction from increasing efficiency through elimination of the superannuated, it is often claimed that pension systems increase the efficiency of the active force. As already pointed out, the very fact that superannuated workers are thus provided for may exert a favorable influence upon the active members of the force and increase their good will, and thus perhaps their efficiency as well. Again, to the extent that a pension system relieves the worker during the stress period of life of anxiety over his declining years, he is, it is urged, in better condition, mentally and physically, to perform his daily tasks.

That pension systems do not materially increase efficiency of the active force was the conclusion reached by the Industrial Bureau of The Merchant's Association of New York, based upon a study of private pension systems made in 1919. Analyzing the replies of fifty-nine employers with respect to the effect on efficiency, the report in question said:

"That failure to produce increased efficiency can be traced to the fact that, in general, pension systems appeal only to employees who have grown old in their present employment. These employees usually constitute a relatively unimportant part of the entire working force and their habits of inefficiency, like all other habits, have become more or less fixed.

In any event, the effect of a pension system on the efficiency of the active force will depend largely upon the terms of the plan, partly upon its certainty from the viewpoint of the employee, partly upon the character of the employee, and very largely upon his age. That it will not be an important factor in the case of the younger workers is practically certain.

Decomposition of Clays

The decomposition of clays and kaolins by means of $(NH_4)_2SO_4$ and the individual factors involved were studied. The decomposition proceeds as if first $(NH_4)HSO_4$ and ammonium alum were produced, which reaction would go up to 357 degrees, and next NH_3, and $(NH_4)_2SO_4$ were driven off from the alum, which reaction would begin at 420-30 degrees and end above 450 degrees. The temperature of decomposition affects the losses of NH_3, since up to 360 degrees about 0.5% NH_3 used in the reaction is oxidized and ammonium alum is leached out of the products, while at 450 degrees about 9% NH_3 is oxidized and at the same time $Al_2(SO_4)_3$ is obtained. A curve showing the relationship between the temperature and per cent NH_3 oxidized is given. Clays of varying chemical composition decomposed at different times and in different ways, e. g., clays with a higher Fe_2O_3 content release NH_3 more easily and quickly than those of lower Fe_2O_3 content, and those free from Fe_2O_3 resist conversion to $Al_2(SO_4)_3$. L. Wasilewski. (Przemysl Chem. *12* p. 40-48, 1928). C. A.

Acidity of Japanese Acid Clay

Analyses of the chief Japanese acid clays suggest that the clay is a mixture of colloidal hydrated Al silicates and an amorphous anhydrated compound of orthosilicic acid, and may be expressed as $Al_2O_3 . 6SiO_2 . xH_2O$, x being greater than 6. The clay is not a true acid, the acid reaction being due to free acid liberated by the absorption of the clay to the indicator and the reaction is similar in nature to that with silk and wool fibers. K. Kobayashi, (Mem. Faculty Sci. Eng. Tokyo *4*, p. 1-2, 1927). Analyst 52, p. 559). C. A.

PIT AND QUARRY FOREIGN DIGEST

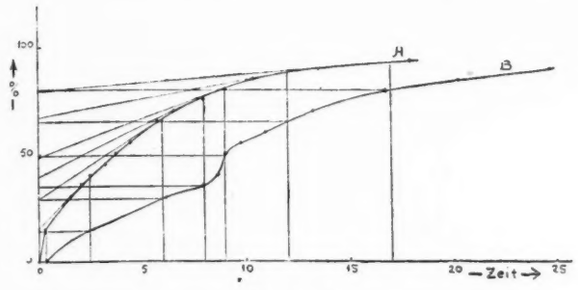


Figure 1

Grain Size of Cement

A method has been devised which utilizes the principle of the falling of the particles through a liquid, in this case absolute alcohol. The time required for each size of particle is accurately measured. As each size of grain requires a known interval to precipitate to the bottom of the apparatus, plotting the proportion of the sediment against

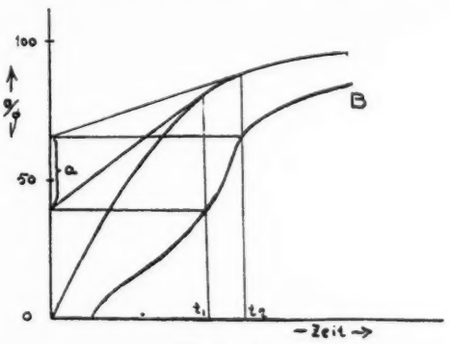


Figure 2

time, the grain size can be read off directly as ordinates. It is usually necessary to notice only the time for the first sediment to reach the bottom, as this figure will give the maximum grain size present. In comparison with the older sedimentation methods, working with completely filled sedimentation cylinders the newer procedure is much simpler. As shown in Figure 1, when using the older (Wiegner) method it is necessary to construct tangents to the curve (A) to get the correct grain size indicated on the ordinates. The new

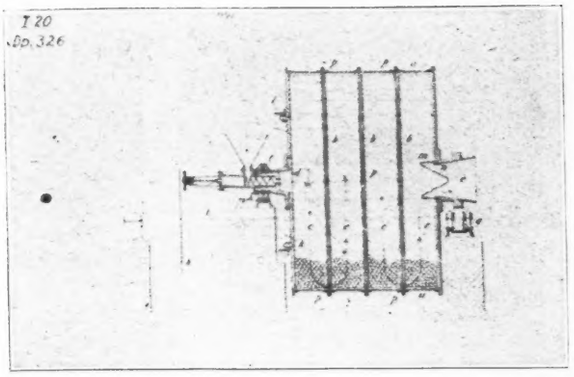


Figure 4

method can be read directly from the curve (B). This not only is simpler but reduces the chance of error. Figure 2 shows the two methods used in determining the grain size of sand. The abscissae are time and the ordinates percent of total precipate. The following table shows the size of

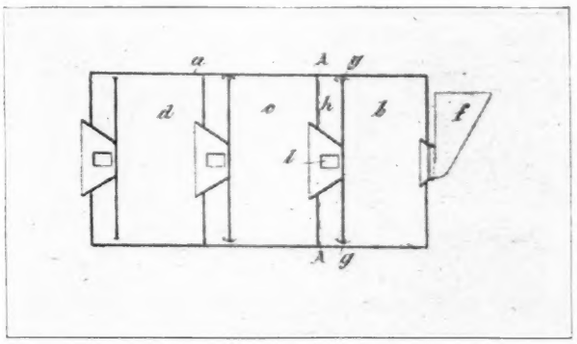


Figure 5

grain corresponding to time of precipitation:

Time in Minutes.	Radius in 0.001 mm. (=0.000004 inch.)	Time in Minutes.	Radius in 0.001 mm. (=0.000004 inch.)
2 min. 15 sec.	50	40 min.	12
3 min. 30 sec.	40	57 min.	10
		1 hr. 30 min.	8
6 min. 10 sec.	30	2 hr. 40 min.	6
9 min.	25	5 hr. 55 min.	4
14 min. 30 sec.	20	24 hr. —	2
25 min.	15	Infinity	0

—Werner and Giertz-Hedstrom (Zement, July, 1928).

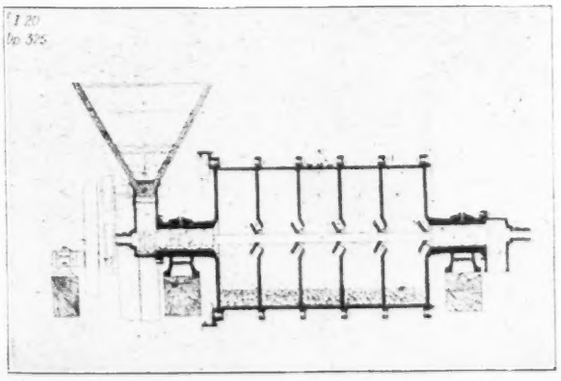


Figure 3

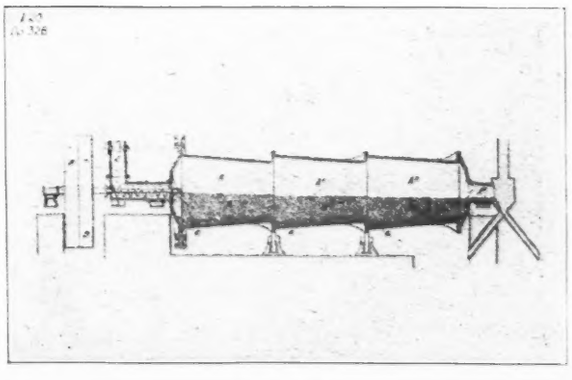


Figure 6

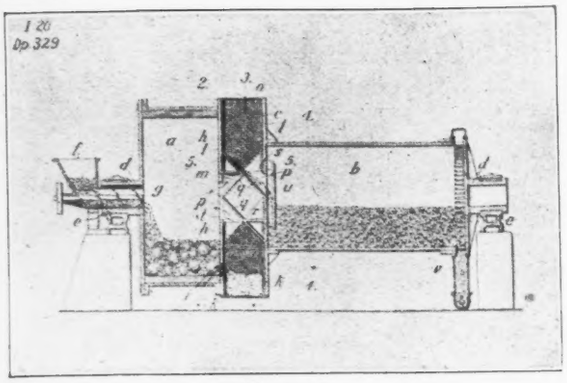


Figure 7

Development of German Tube Mills

Figure 3 shows a multiple chamber tube mill patented in 1886. Figure 4 shows a multiple chamber mill of 1896. Figure 5 shows a mill of three chambers patented in 1901. Figure 6 shows a mill divided into three parts, in which the most finely divided material moved fastest. Figure 7 shows a combined ball and tube mill designated in 1905. Figure 8 shows a tube mill still in wide use, with a single chamber. Figure 9 is a mill with a crushing chamber for larger pieces at the inlet. Figure 10 shows a compound mill with a sieve to keep the large pieces in the crushing space. Figure 11 shows a tube mill developed last year, which may have 3, 4 or more chambers.—C. Mittag (Zement, July 5, 1928).

Chemical Utilization of Gypsum

The only two successful processes for the chemical utilization of gypsum comprise the manufacture of (1) H_2SO_4 by the contact process from SO_2 obtained by heating a mixture of gypsum SiO_2, Al_2O_3 and coal in a rotary cement furnace, the residual clinker being used for making cement, and (2) $(NH_4)_2SO_4$ and $CaCO_3$, by passing NH_3 and CO_2 into an aqueous suspension of powdered gypsum. Experiments show that, in the presence of water, equimolecular proportions of $(CaSO_4)_2$, H_2O and $MgCO_3$ react at ordinary temperatures, a solution containing about 50 grams per 1. of $MgSO_4$ being obtained after 45 days. With $CaSO_4$, $2H_2O$ the reaction is slower, and the resulting $MgSO_4$ solution contains only 30-35 grams per 1. Other uses for

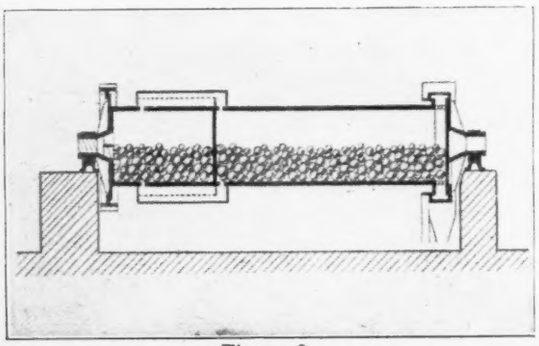


Figure 8

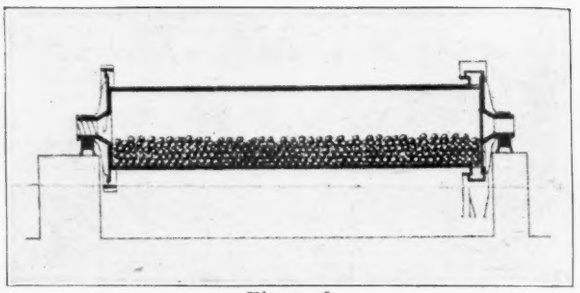


Figure 9

$MgSO_4$ are being sought. G. Gallo (British Chemical Abstracts) *12*, 1928. C. A.

Concrete Roads in Holland

The concrete was laid in two beds, the lower layer consisting of coarser aggregate and a leaner mix. This procedure was found more economical. The composition of the concrete used was as follows: Upper layer—2,200 lbs. cement, 1.3 cubic yards of sand and 2.6 cubic yards of gravel. Lower layer—2,200 lbs, cement, 1.75 cubic yards of sand and 3.5 cubic yards of gravel. The specifications for the cement were:

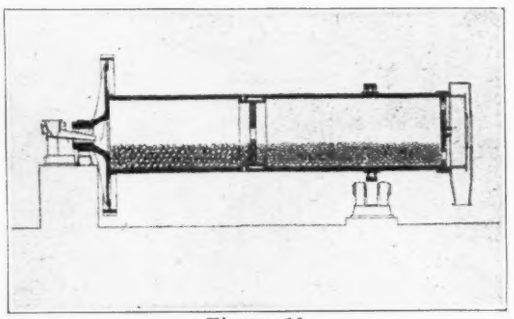


Figure 10

Fineness: A residue of not more than 3% on the 900 mesh (per sq. cm.) sieve, and not more than 25% on the 4900 mesh (per sq. cm.) sieve. Tensile strength—A mortar 1.3, cement: sand after curing 1 day in moist air and 6 days under water must show a strength of at least 300 lbs. per sq. in. Under similar conditions the compressive strength must be at least 3800 lbs. per sq. in. L. R. Wentholt (Le Ciment, June, 1928).

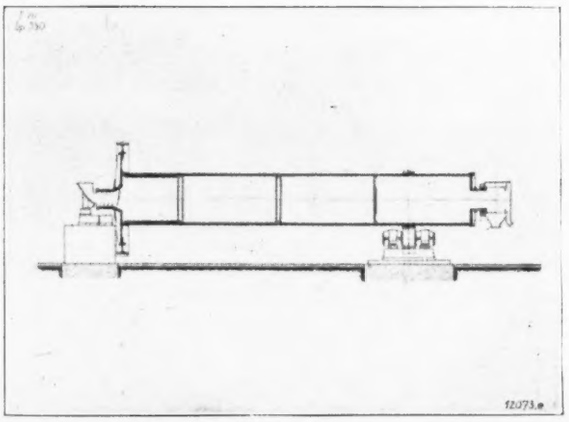


Figure 11

INTIMATE NEWS OF MEN AND PLANTS

Virginia Silica Sand Plant Proposed

The Eastern Silica and Chemical Corporation, with principal offices in Winchester, Virginia, has purchased 188 acres of land in the western part of Frederick County from the Winchester Glass Sand Corporation. The new owners, who only recently obtained their charter, plan to equip the mines with new and modern machinery and will begin operations with a capacity of 10 cars per day.

Officers are: John F. Penrose, president; F. Vechin, vice president; G. Fowl, secretary-treasurer. All of these men are of New York City and together with D. H. Sencindiver of Winchester, constitute the board of directors.

Washington Plant Builds

The Harbor Sand and Gravel Company of Mantesano, Washington, recently completed a new office building.

Gypsum in 1927

The gypsum industry in 1927, though very active, was not quite so productive as in 1926, according to a statement made public by the United States Bureau of Mines, Department of Commerce, based on reports received from 60 operators in 17 States and collected in co-operation with the Geological Surveys of Iowa, Kansas, Michigan, New York, Oklahoma, Texas and Virginia.

The quantity of gypsum mined in the United States in 1927 was 5,346,888 short tons, a decrease of 288,553 tons, or 5 per cent, compared with 1926. This production has been exceeded only in 1925 and 1926, and was about twice as large as that of 1917.

The total value of the gypsum sold or used by producers was $42,174,454, a decrease of $4,546,765 or 10 per cent, compared with 1926. The quantity of gypsum sold by producers without calcining in 1927 was 965,371 short tons, a slight increase over 1926, and was valued at $2,388,663, or $2.47 per ton, a decrease of 14 cents per ton; the quantity of calcined gypsum sold or used by producers was 3,912,211 tons, a decrease of 103,763 tons, or 3 per cent, and was valued at $39,785,791, or $10.17 per ton. This was a decrease of 10 per cent in total value and 84 cents per ton compared with 1926.

New York continues to be the largest producer of gypsum. The production of crude gypsum in that State in 1927 was 1,675,501 tons, a decrease of 3 per cent from that of 1926. This was nearly one-third of the entire quantity mined in the United States and more than twice as large as that of the second state, Iowa. New York is also the larger seller of gypsum, marketing 290,368 tons without calcining, or 30 per cent of the United States total, and 1,291,967 tons calcined, or 33 per cent of the total. These figures represent a decrease of 11 per cent in the uncalcined and an increase of 4 per cent in the calcined gypsum compared with 1926. Other important States in the production of crude gypsum in 1927 were Iowa, 792,159 tons; Michigan, 668,617 tons; Texas, 508,382 tons; Ohio, 474,320 tons; Nevada, 327,365 tons; and Oklahoma, 271,484 tons. The first five of these States reported 77 per cent of the total production.

GYPSUM MINED AND UNCALCINED AND CALCINED GYPSUM SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 1927, BY STATES

State	Number of active plants	Total quantity mined (Short tons)	Sold or used by producers: Without calcining, Short tons	Without calcining, Value	Calcined, Short tons	Calcined, Value	Total value
Iowa	7	792,159	139,637	$ 391,701	584,305	$ 6,321,796	$ 6,713,497
Kansas	3	175,351	37,027	67,474	98,737	908,175	975,649
Michigan	6	668,617	178,378	331,837	429,639	3,884,687	4,216,524
Nevada	5	327,365	61,303	184,452	217,931	1,299,719	1,484,171
New York	11	1,675,501	290,368	792,410	1,291,967	14,096,980	14,889,390
Ohio	3	474,320	11,210	30,761	456,817	5,011,118	5,041,879
Oklahoma	4	271,484	(a)	(a)	(a)	(a)	2,073,944
Texas	4	508,382	(a)	(a)	(a)	(a)	4,003,456
Other States (b)	17	453,709	(c)247,448	(c)590,028	(c)832,815	(c) 8,263,316	2,775,944
	60	5,346,888	965,371	2,388,663	3,912,211	39,785,791	42,174,454

(a) Included under "Other States."
(b) Includes Arizona, California, Colorado, Montana, New Mexico, South Dakota, Utah, Virginia and Wyoming.
(c) This figure includes also sales from Oklahoma and Texas.

Michigan Plant Dissolves Partnership

The Soo Sand and Gravel Company, Sault Ste. Marie, Michigan, is to continue under the same name under the management of Fred C. Lapish, Thomas A. Small having retired from the firm.

Illinois Plant Plans Expansion

The A. Y. Reed Gravel Company of Dundee, Illinois, plans to increase capacity to 4,000 tons per day and to install a dredge and pumping equipment to replace the present dragline and locomotives, according to Charles A. Jacobs, secretary and general manager of the company. Mr. Jacobs' office is in the Builder's Exchange Building, Chicago.

Michigan Plant Expands

E. E. Foster is rebuilding the sand and gravel plant at Prospect Hill, Michigan, and is installing new equipment. A crusher, dragline, and several motors are now being installed and 750 feet of sidetrack will be rebuilt.

Louis Garbi Joins Western Amiesite

Louis Garbi, C. E., has been added to the organization of the Western Amiesite Asphalt Company, 310 South Michigan Avenue, Chicago, in the capacity of consulting engineer.

New Colorado Granite Plant

The Stonehenge Granite Company is to build a finishing plant at Salida, Colorado, the main building being 60 feet wide by 610 feet long. The necessary equipment is on the way and the contract for the work has been awarded.

Washington Plant Sold

W. R. Osborne of the Harbor Dredging Company has purchased the S. L. Dennis rock crushing and loading plant at the Narrows near Raymond, Washington. The plant, which has only been in operation for a short time, has a capacity of about 30 tons per day.

New Ohio Plant Opens

The Kimble Sand and Gravel Service Company recently commenced operation of the new gravel plant at Coke Otto, near Hamilton, Ohio. Clarence Kimble and Carl Kimble, brothers, are operators and managers.

DISTRIBUTION OF CEMENT

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during April and May, 1927 and 1928.

Portland cement shipped from mills into States in April and May, 1927 and 1928, in barrels*

Shipped to—	April		May	
	1927	1928	1927	1928
Alabama	173,893	233,865	164,359	294,946
Alaska	1,037	542	2,514	588
Arizona	47,573	64,808	46,724	23,982
Arkansas	53,331	86,513	77,207	120,605
California	1,137,845	1,058,739	1,281,461	1,101,338
Colorado	86,431	90,312	109,671	122,205
Connecticut	179,863	187,697	193,315	273,367
Delaware	40,699	26,177	35,564	35,361
District of Columbia	89,048	66,108	79,566	66,508
Florida	271,575	134,647	234,914	90,435
Georgia	168,681	155,787	209,126	167,422
Hawaii	25,876	19,314	25,631	29,807
Idaho	32,063	30,832	26,767	35,009
Illinois	956,012	1,192,251	1,402,964	2,087,924
Indiana	418,874	355,434	561,019	568,668
Iowa	211,248	405,654	357,184	929,356
Kansas	203,368	202,705	294,596	250,076
Kentucky	148,567	130,168	188,319	178,020
Louisiana	107,023	112,667	116,352	110,257
Maine	39,031	30,015	49,870	49,458
Maryland	224,405	176,807	224,398	250,926
Massachusetts	293,606	256,150	289,218	306,685
Michigan	857,574	710,731	1,258,924	1,218,783
Minnesota	258,506	185,901	387,814	446,443
Mississippi	78,127	73,651	74,061	89,421
Missouri	312,311	383,704	409,889	473,066
Montana	23,882	32,676	24,561	50,054
Nebraska	96,255	108,224	155,964	131,720
Nevada	10,406	7,195	7,495	11,050
New Hampshire	43,932	34,667	38,333	48,034
New Jersey	897,645	778,746	894,457	899,439
New Mexico	28,566	27,664	31,149	30,612
New York	2,131,528	1,758,888	2,188,026	2,414,892
North Carolina	324,758	199,340	367,215	259,658
North Dakota	38,157	34,627	40,034	69,986
Ohio	837,050	776,992	966,808	1,263,450
Oklahoma	242,747	209,850	309,509	307,249
Oregon	122,281	102,480	152,050	143,000
Pennsylvania	1,199,544	928,060	1,331,265	1,396,046
Porto Rico	1,000	0	2,250	500
Rhode Island	78,743	81,029	77,876	93,304
South Carolina	82,680	101,838	87,442	141,083
South Dakota	35,465	42,599	38,442	65,137
Tennessee	180,574	216,928	217,416	274,229
Texas	472,879	526,063	545,848	601,278
Utah	31,793	36,932	32,759	38,520
Vermont	30,185	27,791	29,715	43,912
Virginia	135,226	175,192	168,463	201,315
Washington	248,518	237,749	223,574	315,209
West Virginia	112,009	103,682	141,521	151,015
Wisconsin	356,961	287,693	568,828	615,376
Wyoming	14,783	15,229	17,531	18,033
Unspecified	102,398	41,738	46,626†	27,702
	14,296,532	13,265,051	16,806,584†	18,932,459
Foreign Countries	53,468	41,949	58,416	53,541
Total shipped from cement plants	14,350,000	13,307,000	16,865,000	18,986,000

* Includes estimated distribution of shipments from three plants each month.
† Revised.

Relation of Production to Capacity

	June		May	April	March
	1928	1927	1928	1928	1928
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	90.1	93.1	86.6	70.0	51.7
The 12 months ended	73.8	74.3	73.9	74.0	74.6

Production, shipments and stocks of finished Portland cement, by months, in 1927 and 1928. (In thousands of barrels)

Month—	Production		Shipments		Stocks at end of month	
	1927	1928	1927	1928	1927	1928
January	8,258	9,768	5,968	6,541	22,914	25,116
February	7,377	8,797	6,731	6,563	23,563	27,349
March	11,450	10,223	11,100	10,135	23,922	27,445
April	14,048	13,468	14,350	13,307	23,654	27,627
May	16,701	17,280	16,865	18,486	23,503	*25,972
June	17,224	17,469	19,761	18,421	20,972	25,021
July	17,408	.....	18,984	.....	19,397	.....
August	18,315	.....	21,411	.....	16,292	.....
September	17,505	.....	19,828	.....	13,996	.....
October	17,174	.....	18,105	.....	13,141	.....
November	14,449	.....	11,619	.....	16,022	.....
December	11,999	.....	6,200	.....	22,082	.....
	171,908	.....	170,922	.....	.....	.....

Production and stocks of clinker, by months, in 1927 and 1928. (In thousands of barrels)

Month	Production		Stocks at end of month		Month	Production		Stocks at end of month	
	1927	1928	1927	1928		1927	1928	1927	1928
Jan.	10,410	11,839	9,989	9,672	July	15,697	.....	9,609	.....
Feb.	9,253	11,363	11,943	12,237	Aug.	16,396	.....	7,887	.....
March	12,397	12,501	12,997	14,463	Sept.	15,931	.....	6,490	.....
April	14,246	13,844	13,335	15,002	Oct.	16,469	.....	5,960	.....
May	15,677	16,025	12,514	*14,320	Nov.	14,698	.....	6,374	.....
June	15,437	15,941	10,926	12,936	Dec.	13,177	.....	7,660	.....

* Revised.

CEMENT STATISTICS FOR JUNE 1928

The Portland cement industry in June, 1928, produced 17,469,000 barrels, shipped 18,421,000 barrels from the mills, and had in stock at the end of the month 25,021,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of Portland cement in June, 1928, showed an increase of 1.4 per cent and shipments a decrease of 6.8 per cent, as compared with June, 1927. Portland cement stocks at the mills were 19.3 per cent higher than a year ago. The total production for the first half of 1928 amounts to 77,005,000 barrels, compared with 75,058,000 barrels in the same period of 1927, and the total shipments for the first half of 1928 amount to 73,953,000 barrels, compared with 74,775,000 barrels in the same period of 1927.

The statistics here presented are compiled from reports for June from all manufacturing plants except two for which estimates have been included in lieu of actual returns. They include the output of another new plant, located in Tennessee, which began operating during the month.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 158 plants at the close of June, 1928, and of 148 plants at the close of June, 1927.

New Kentucky Stone Quarry

The Sunbeam Quarries Company, recently organized, plans to open a quarry and crushed stone plant at Clermont, Bullitt County, Kentucky, according to an announcement by Mr. T. J. Beam of that company. The crushing plant, which will have a 1500 ton daily capacity, will be on the Louisville and Nashville Railway. General offices and storage yards will be built in Louisville. Gasoline loading shovels and locomotives will be used at the plant.

Michigan Firm to Build New Plant

The Manistique Lime and Stone Company, of Manistique and Marblehead Spur, Michigan, recently completed an exchange with the State of Michigan whereby it became the owner of a tract of land containing large deposits of limestone south of Blaney in Schoolcraft County. A railroad, a harbor in Lake Michigan and a crushed stone and lime plant will be built.

EXPORTS AND IMPORTS

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision

Exports of hydraulic cement by countries in May, 1928

Exported to—	Barrels	Value
Canada	4,821	$ 27,604
Central America	4,716	13,952
Cuba	27,105	50,757
Other West Indies	1,762	4,702
Mexico	7,222	22,655
South America	15,732	65,859
Other countries	8,815	50,476
	70,173	$236,005

Imports of hydraulic cement by countries, and by districts, in May, 1928

Imported from—	District into which imported	Barrels	Value
Belgium	Galveston	1,847	$ 2,403
	Hawaii	9,040	11,393
	Massachusetts	59,782	75,013
	New Orleans	3	5
	New York	19,700	30,545
	Oregon	13,000	16,356
	Philadelphia	25,248	36,914
	South Carolina	25,000	30,968
	Washington	12,717	15,816
	Total	166,337	$219,413
Canada	Maine and New Hampshire	1,500	3,044
Denmark	Porto Rico	17,053	22,956
France	New York	1,341	3,005
United Kingdom	Los Angeles	1,001	2,449
	New York	3	14
	Total	1,004	$ 2,463
Germany	New York	2,524	5,028
	Philadelphia	750	963
	Total	3,274	$ 5,991
	Grand total	190,509	$256,872

Exports and imports of hydraulic cement, by months, in 1927 and 1928

Month	Exports				Imports			
	1927		1928		1927		1928	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	75,346	$ 254,072	56,400	$204,875	193,175	$ 269,661	234,753	$342,797
February	71,404	233,985	62,828	221,620	130,421	200,680	164,408	217,525
March	67,956	240,165	74,983	265,719	181,145	261,519	235,930	330,074
April	72,383	243,832	61,676	205,882	192,318	313,262	249,458	324,371
May	59,332	205,574	70,173	236,005	178,929	263,618	190,509	256,872
June	69,205	237,281	.....	.....	129,111	201,682	.....	.....
July	72,337	249,737	.....	.....	175,042	249,665	.....	.....
August	61,371	209,198	.....	.....	117,605	170,167	.....	.....
September	57,890	207,817	.....	.....	233,066	304,796	.....	.....
October	67,639	230,668	.....	.....	221,274	321,777	.....	.....
November	79,764	257,428	.....	.....	141,485	190,419	.....	.....
December	62,099	226,960	.....	.....	156,609	209,205	.....	.....
	816,726	$2,796,717	.....	.....	2,050,180	$2,956,451	.....	.....

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in May, 1928

	Barrels	Value
Alaska	1,880	$ 5,595
Hawaii	19,813	44,862
Porto Rico	2,080	5,333
	23,773	$55,790

Production and stocks of clinker (unground cement), by districts, in June, 1927 and 1928. (In thousands of barrels)

District	Production		Stocks at end of month	
	1927	1928	1927	1928
Eastern Pennsylvania, New Jersey, and Maryland	3,692	3,665	1,407	1,941
New York and Maine†	1,070	1,152	505	995
Ohio, Western Pennsylvania, and Western Virginia	1,528	1,727	1,422	1,938
Michigan	1,286	1,270	1,383	1,699
Wisconsin, Illinois, Indiana, and Kentucky	1,988	1,916	1,406	1,506
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	1,363	1,366	870	948
Eastern Missouri, Iowa, Minnesota, and South Dakota	1,344	1,584	732	900
Western Missouri, Nebraska, Kansas, and Oklahoma	896	1,031	554	563
Texas	472	479	177	94
Colorado, Montana, and Utah	147	256	639	402
California	1,343	1,137	1,233	1,373
Oregon and Washington	308	358	598	577
	15,437	15,941	10,926	12,936

Minnesota Granite Company Plans Expansion

The Greene-Gregnon Granite Company, 1814-16 West Superior Street, Duluth, Minnesota, has acquired property just west of the present location. According to Mr. Benjamin Greene, proprietor, the plant and showrooms will be enlarged.

Georgia Plant Installs New Washers

The Augusta Sand and Gravel Company, with a plant at Hamburg, Georgia, recently installed new machinery for additional washing of the sand and gravel. Norman A. Hicks is proprietor of the company.

Utah Rock Asphalt Plant Nears Completion

The Utah Rock Asphalt Corporation is completing installation of new machinery at the new crushing plant near Sunnyside, Utah. The six mile spur line from the Denver and Rio Grande Railway at Sunnyside to the site at Silica has been completed.

Officers are: C. N. Power of Chicago, Dr. Herbert A. Black of Colorado Springs, and Major General John F. Cregin, U. S. A., retired, of Pueblo. Henry J. Jones is general superintendent.

New Michigan Cement Plant Under Way

The Newaygo Portland Cement Company, operating plants at Newaygo and Grand Rapids, Michigan, will soon begin building a new cement plant near Charlevoix. J. B. John, president of the company, says that $500,000 has already been spent in dredging a channel from Lake Michigan to the site to allow freighters to load direct form the plant by a blower system, and estimates that $1,000,000 more will be spent on the plant.

Granite Firm Plans Office

The North Carolina Granite Corporation of Mount Airy, North Carolina, plans to build a new $35,000 office building.

Indiana Plant to Expand

The Delaware Sand and Gravel Company of Muncie, Indiana, has increased its capital stock from $30,000 to $75,000, according to an announcement by C. D. Binford, manager. The increase will furnish funds for an extension of the present equipment and an addition to the office, as well as for other general improvements.

New Illinois Silica Sand Company Formed

Ottawa Sands, Incorporated, a company recently formed with a capital of $500,000, has purchased a 76 acre tract of land near Joliet, Illinois, on which a silica sand plant is to be constructed. The plant is to have a 45 ton capacity in ten hours. A 2½ yard steam shovel, a 4 yard steam shovel and a rock crusher have already been purchased.

The incorporators are Hiram A. Cooley, Arthur B. Hewson, and John A. Balko, all of Chicago. Mr. Cooley will be in charge of construction and operations, while Mr. Hewson will be in charge of sales in the Chicago office of the company which will be in the Conway Building.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,673,866. Tractor scoop. Thomas H. Daly, Dalton, Mass.

1,673,911. Double-dump skip-hoist. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,674,434. Combined crusher and grinding mill. Frank Gross, Idaho Springs, Colo.

1,674,620. Concrete machinery. Charles M. Eberling, Cleveland, Ohio, assignor to Eberling Machine Sales Co., same place.

1,674,870. Tunneling-machine. Edmund C. Morgan, New York, N. Y.

1,674,989. Concrete-transporting vehicle. John D. Powell, Cincinnati, Ohio.

1,675,180. Mining-machine. Nils D. Levin, Columbus, Ohio, assignor to Jeffrey Mfg. Co., same place.

1,675,417. Grinding-mill screen. William F. McMahon, Riverside, Cal.

1,675,723. Mining and loading machine. Edmund C. Morgan, New York, N. Y.

1,675,902. Mining and loading apparatus. Edmund C. Morgan, New York, N. Y.

1,676,097. Coal digging and loading machine. George R. Lang, Pittsburgh, Pa.

1,676,353. Crane and shovel convertible operating mechanism. Leslie A. Russell, Milwaukee, Wis., assignor to Koehring Co., same place.

1,676,428. Mining-machine. Charles E. Davis, Chicago, Ill., assignor to Goodman Mfg. Co., same place.

1,676,429. Mining-machine. Charles E. Davis, Chicago, Ill., assignor to Goodman Mfg. Co., same place.

New Feldspar Plant Planned For North Carolina

The North Carolina Feldspar Company has let a contract for the erection of a 100 ton daily capacity feldspar grinding plant at Dowditch, North Carolina. J. F. Shinn of Norwood is president of the company which is capitalized at $500,000.

Oregon Company Elects Directors

The Ross Island Sand and Gravel Company of Portland, Oregon, recently elected a board of nine directors. These were D. L. Carpenter, W. H. Murhead, Charles Swigert, E. C. Nelson, Harold Blake, Aaron Holtz, W. G. Brown, Palmer L. Fales, and Russell Hawkins.

U. S. Gypsum Plans New Plant in Detroit

The United States Gypsum Company, preparatory to the erection of a gypsum plant in that city, has transferred its district offices from Chicago to Detroit. H. F. Sadler will be in charge. The new plant at Davison Street and the River Rouge will obtain its supply of raw gypsum rock by boat from Alabaster, Michigan. Finished products will be shipped to Michigan, Ohio and other convenient points.

The central-eastern district sales office has been transferred from Chicago to 638 Ellicott Square Building, Buffalo, New York. Walter T. Coe is district sales manager.

Pennsylvania Plant Sold

The Keystone Portland Cement Company of Bath, Pennsylvania, whose new plant in that city is nearing completion, has been sold to John Barnes of Philadelphia for approximately $3,000,000. The new owner plans to enlarge the plant.

Maine Cement Plant Adds

The Lawrence Portland Cement Company at Thomaston, Maine, plans two new buildings which are to be added to the plant. A storage house 30 by 100 feet is to be built and used exclusively for the storage of brick linings for the kilns and coolers. A smaller structure is to be built with storage room for 2 carloads of dynamite. Three other buildings are now being remodeled.

New Incorporations

Reef Rock Asphalt Co., Inc. New Orleans, La. Capital $10,000. John W. Farmer, 7104 Spruce St.

Southern Lime Products Company. Limestone, limerock, 3000 shares n.p.v. A. V. Lane, H. W. Kennedy, Jr., Alfred Jervis, Wilmington, Del. (Corporation Trust Co. of America.)

National Lime Cement and By-Products Corp., New York, increased capital from 10,000 to 25,000 shares n.p.v. (Corporation Registry Co.)

Lime Products Co., Wauwatosa, Wisc. $50,000, Benj. F. Siegert, Esther A. Siegert.

Superior Lime Co., Fairmont,W. Va. $50,000. Ira A. Adkins.

Comanche Sand & Gravel Co., care Corporation Trust Co. of America, Wilmington, Del. 1000 shares n.p.v. A. V. Lane, H. W. Kennedy, Jr., Alfred Jarvis, all of Wilmington, Del.

Colgrove Sand and Gravel Co., Portsmouth, O., $10,000. C. L. Cordwell, R. N. Larrimer, Wm. J. Colgrove.

Oakwood Gravel Co., Dayton, O. $25,000. Clark J. Bell, Paul A. Nill. Isaiah H. Bell.

Camden Gravel Co., Camden, S. C. Capital $35,000. Inc. J. B. Zemp, J. P. Wilson.

South Carolina Granite Corp., Wilmington, Del. 100,000 shares common. A. V. Lane, H. W. Kennedy, Jr., Alfred Jervis, Wilmington Corp. Trust Co. of America, Wilmington, Del.

Oneida Pink Granite Co., $350,000. H. Edwards, 33 West 42nd St., New York.

Scioli & Colidonio, Inc., $50,000, crushed stone, Fairview, N. J. Victor Colidonio, Dan Colidonio, both of Fairview, Edmindio Sciolo, Cliffside. Attorney, Joseph W. Murini, Cliffside.

Avon Mountain Quarries, Inc., Hartford, Conn. $100,000. Louis Toffalon, 1097 W. Main St., New Britain, and others.

Silica Products Co., Kansas City, Mo. Increase in capital stock 20 to 500 shares n.p.v. Corporation Trust Co. of America, Wilmington, Del.

Chesapeake Marble Corp., $1,250,000. H. B. Money, B. E. Newkirk, B. F. Powell, Wilmington, Del. (Colonial Charter Co.)

United Talc and Crayon Mfg. Co., Glendon, N. C., $200,000. Abraham L. Luff, Glendon, Eli Ginsberg and Geo. H. Humber, Carthage.

Pocasset Granite Co., Providence, R. I. 500 shares n.p.v. Jos. Bastianon, 99 Pocasset Ave., Providence; A. Bastianon, J. McAsker.

Abel Magnesia Company in Merger

The Abel Magnesia Company, of Cedarville, Ohio, will merge with the interests of Carter N. Abel, who manufacturers steel furnace refractories and kindred products. Assets of both organizations will be combined.

U. S. Gypsum Awards Contract for East Chicago Plant

The United States Gypsum Company has awarded the general management service contract covering the entire construction of the new $2,500,000 plant in East Chicago, Indiana, to the Turner Construction Company.

This work will include 1,000 feet of docks and bulkhead, gypsum rock storage bins with a capacity of 125,000 tons, a large group of steel and brick buildings, power house, office buildings, railroad track and roads. Work will be started immediately under the supervision of J. H. Nold, chief engineer of the U. S. Gypsum Company.

Ohio to Get New Cement Mill

The Great Lakes Portland Cement Company, with offices in the Marine Bank Building, Buffalo, New York, plans to build a new four story mill building on the Cuyahoga River near Cleveland, Ohio, at a cost of more than $350,000, including equipment.

North Carolina Feldspar Plant Planned

The Feldspar Milling Company was recently organized, with a capital of $150,000, and plans to erect a feldspar grinding mill near Bowditch, Yancey County, North Carolina. The new company has secured 1,100 acres of land and plans an initial capacity of 100 tons daily. Carrol P. Rogers, Tryon, is president, and H. A. Dunham, Asheville, is secretary and treasurer.

Missouri Quarry Purchased by Iowa Company

The Concrete Materials Corporation of Waterloo, Iowa, which recently took over the stone quarry at Bethany, Missouri, has appointed D. R. Keedwell of Independence as superintendent. The quarry is now being cleaned up, the crushers and other machinery put in condition, and new motors and machinery being installed. A P and H ¾-yard gasoline shovel will be used for stripping. Two shifts a day will be operated and a capacity of about 800 yards daily is planned. H. D. Bellamy is president, and T. E. Rust, vice president and general manager of the Waterloo company.

Universal Cement Appoints

New appointments by the Universal Portland Cement Company have been announced by F. L. Stone, General Sales Manager, as follows: A. C. Cronkrite, Assistant General Sales Manager; Edward Quebbeman, Western Sales Manager; W. L. Greenly, Division Sales Manager for Chicago; Harry A. Craig, Division Sales Manager for Illinois and Missouri; Earle D. McKay, Division Sales Manager at Duluth.

Mr. Cronkrite, the new Assistant General Sales Manager, has been with the Universal company more than twenty years. After seven years as salesman in Wisconsin, he specialized in work with railroads and railroad contractors. He was Division Sales Manager for Chicago from 1915 until his present appointment. He has been chairman of the membership committee and general secretary of the Chicago Association of Commerce and active in the work of the American Road Builders Association. He is a member of the Builder's club, Western Society of Engineers, Chicago Association of Commerce, Union League club, Lake Shore Athletic club, Bunker Hill Country club and Rotary club.

Edward Quebbeman, the new Western Sales Manager, is a recipient of the Judge Gary medal for valuable and long-time service. Starting as office boy to B. F. Affleck, now president of the Universal company, in the St. Louis office in 1896, Mr. Quebbeman served successively as clerk, office correspondent, salesman, Southwestern Sales Manager, and Division Sales Manager for Illinois and Missouri. He is a member of the Western Society of Engineers and of the Edgewood Valley Country club.

The entire business experience—eighteen years—of W. L. Greenly, Division Sales Manager for Chicago, has been with the Universal company. After graduating from the University of Minnesota, he joined the Minneapolis office as salesman, later was in charge of sales in the Dakotas and Montana, and in 1918, after the New Universal plant was built at Duluth, became Division Sales Manager for that district. While at Duluth, Mr. Greenly was a member of the Engineers' club, Builders Exchange, Chamber of Commerce, Kitchi Gammi club and University club of St. Paul.

The new Division Sales Manager for Illinois and Missouri, Harry A. Craig, has been with the company since 1912. Previously he was in the lumber manufacturing business in Wisconsin and Minnesota. His first four years with Universal were in its Publicity Bureau where, in addition to publicity work, he aided in arranging and conducting several of the large cement shows held in Chicago and other cities. In 1916 he entered the Sales Department where he was employed successively as clerk, chief clerk and correspondent. During the last three years, in addition to his office duties, he has been Detroit Representative for the company.

Both engineering and selling experience are possessed by Earle D. McKay, new Division Sales Manager at Duluth. After receiving his engineering degree at the University of Minnesota, he was employed by the Standard Oil Co. of New York for two years, one of which was spent in China. He returned to America to enter war service as a naval aviator. After the war he was sales engineer for U. S. Casualty Co. of New York City. In 1920 he joined the Universal company and for eight years was field engineer for the Service Bureau, working out of the Minneapolis office.

"The new appointees have been with the Universal company many years," said Mr. Stone in announcing the appointments. "They are familiar with the needs and problems existing in the construction field and are equipped to render satisfactory service to cement buyers."

Remarkable Drilling Record Set By Iowa Plant

The Pyramid Portland Cement Company of Gilmore City, Iowa, recently established a remarkable record for blast hole drilling. An Armstrong No. 50 B all steel blast hole drill was used. The drilling was done in a formation of medium hard limestone, part of which was broken up by seams and fissures.

4007 feet of six inch hole was completed in 521 hours 15 minutes, an average of 7.7 feet per hour worked. The actual drilling time, however, was only 384 hours 30 minutes, so that an average of 10.4 feet per hour of drilling time was maintained. 70 hours 25 minutes were spent bailing, 20 hours 55 minutes moving machine, 4 hours 10 minutes changing bits, 16 hours 30 minutes releasing tools stuck in crevices, 21 hours 10 minutes fishing lost tools and 3 hours 35 minutes repairing. The average time required to move the machine was 12.55 minutes.

Ohio Companies Merge

The American Aggregates Corporation of Greenville, Ohio, recently purchased the controlling interest in the Ohio Ballast Company, the Redbank Gravel Company, and the Cincinnati Sand and Gravel Company, for a reported sum of $2,500,000.

Penn Dixie Merger Called Off

Directors of the Pennsylvania-Dixie Cement Corporation, at a recent meeting, decided that the proposed merger with the North American Cement Corporation would not be carried out. John A. Miller, formerly president, became chairman of the board.

Pittsburgh Plant Nears Completion

The new Pittsburgh plant of the Keystone Sand and Gravel Company at South Third Street, near the Liberty bridge, will be in operation sometime in September. A river wall is now being built along the 215 foot frontage of the property on the river. Bins, conveying apparatus and other equipment are being installed. A 550 foot railroad siding is being constructed at the Aliquippa plant.

California Magnesite Plant Nears Completion

The Oxide Minerals Company which bought and reconstructed the Mineral Products plant at Patterson, California, has made experimental runs and plans to commence operations on magnesite and manganese ores soon, according to Homer Wilson, superintendent. A Raymond mill has been installed as well as other new machinery and the total cost of the improvement is estimated at $75,000.

Wisconsin Company Plans Quarry Operation

The Wisconsin Stone and Duntile Company has leased the Brunette stone quarry near Howard, Wisconsin, and plans to begin immediate operation as soon as repairs and new installations are made.

Pennsylvania Cement Company Reorganizes

D. M. Kirk, president of the Crescent Portland Cement Company of Crescentdale, Pennsylvania, has resigned after many years in that position. Joseph Heidenkamp of Pittsburgh has been elected to take Mr. Kirk's place and Judge J. Sharp Wilson, of Beaver County, has been named general manager.

New Arkansas Cement Plant Under Construction

The Arkansas Portland Cement Company, a subsidiary of the Ideal Cement Company of Denver, Colorado, which owns and operates two plants in Oklahoma, three in Colorado, one in Utah, two in Montana, and one in Nebraska, recently announced final plans for the construction of a cement plant two miles north of Saratoga, Arkansas. As a preliminary step, the Grayson, Nashville and Ashdown railroad has been purchased and a contract has been let for the construction of a five-mile industrial track from the railroad at Schaal to the plant.

The plant, when completed, will have a capacity of 1,800,000 barrels of cement a year and will employ from 250 to 300 men. The plant site of 720 acres is owned by the company. The total cost of the project is estimated at $2,000,000. General sales offices for the Arkansas territory will be in Little Rock.

Officials of the company are: C. Boettcher, Denver, president; C. K. Boettcher, Denver, vice-president; C. D. Nichols, Oklahoma City, vice-president in charge of sales; R. J. Morris, Denver, vice-president; D. M. Pinkston, Little Rock, general sales manager; Paul C. Van Zandt, Denver, chief engineer; M. O. Mathews, Ada, Oklahoma; J. W. Dawson, resident chemist.

How's This for Pyramiding?

We have all received chain letters from time to time—silly "good luck" chain letters for instance. But have you ever tried to figure the rapidity with which a chain piles up and avalanches?

For example one received not long ago had on 100 names. The sender wanted the receiver to add his name to the list and send ten copies to friends of his and ask them to do the same.

By doing a little figuring it was found that if instructions were actually followed by every person throughout the entire chain, the number of letters to be written by all those in the 100th circuit would amount to 263090000000000

NEWS OF EQUIPMENT MANUFACTURERS

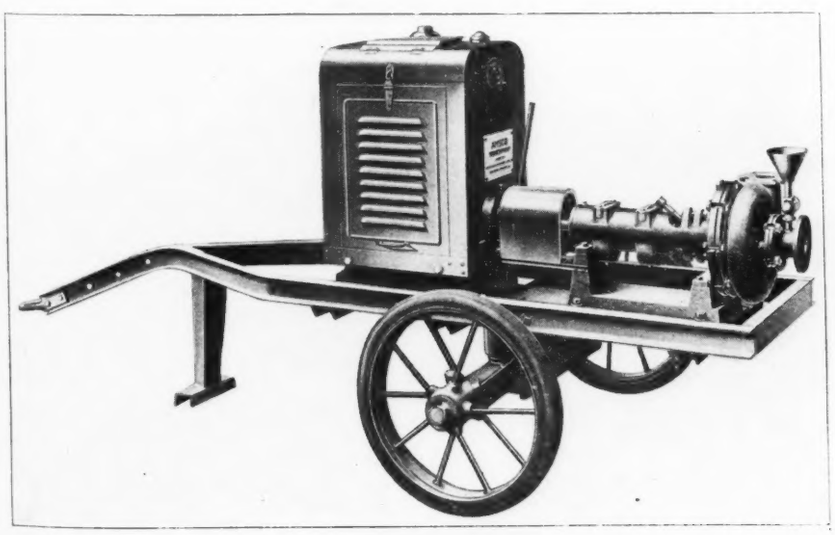
Amsco Portable Pump Units

The American Manganese Steel Company has developed, patented and produced a series of portable pumping units, using manganese steel for the shell, impeller and discs where shock, wear and abrasion are encountered. All parts of the unit are proportioned for maximum wear. A long, ring oiling, babbitted, sleeve bearing supports the shaft to which the impeller is press fitted. The drive shaft is lubricated by a large oil reservoir which also lubricates the thrust bearing. The entire unit is solidly mounted on a base plate, and connected with a flexible coupling through a friction clutch to the power.

The frame is made of 3 inch channels electrically welded upon which the power and pumping units are fastened. A sturdy arm supports the forepart of the frame, and a ring for a standard pintle hook is provided in the frame for towing purposes. Spring shock absorbers on the axle cushion the jars and blows, and roller bearinged rubber tired wheels insure easy, quick handling when moving.

All Amsco portable pumping units are powered with Novo engines which provide a speed range most desirable for efficient operation. These portable pumping units are made with 2 inch discharge and powered with a 6 h. p. 1200 r. p. m. power plant, 2½ inch discharge and powered with an 8 h. p. 1200 r. p. m. power plant, and a 3 inch discharge and powered with a 10 h. p. 1200 r. p. m. power plant.

The 2 inch unit has a pumping capacity of 100 g. p. m. against a 34 foot lift with no horizontal discharge hose, and it will maintain the same capacity through 125 feet of 2 inch hose without vertical lift. The 2½ inch unit has a pumping capacity of 150 g. p. m. against a 34 foot lift with no horizontal hose, or through 150 feet of 2½ inch hose with no lift. The 3 inch unit has an approximate capacity of 230 g. p. m. against a 37 foot lift with no horizontal hose on the discharge end. It has an equal capacity with no lift and when discharging through 200 feet of horizontal hose.



Amsco Portable Pumping Unit

Wire Rope Slings

The John A. Roebling's Sons Company, Trenton, New Jersey, is distributing the 1928 edition of its catalog, "Roebling Wire Rope Slings." The catalog gives a number of illustrations and graphs of the different uses of slings which are included in the 86 pages. Tables of the factor of safety in moving loads are also given and the catalog refers to the different publications of the Company.

Only "Blue Center" steel wire rope is used in the manufacture of slings. Surface indications show the fatigue of steel in wire rope slings by the breaking of individual wires. For heavy loads, the slings are fabricated of 7 strands of 37 wires, 6 strands being twisted about the center strand, each strand having 18 wires on the outside and 19 wires on the inside. The 18 outside wires, due to their location, are subject to abrasion and shock, and are the first to show fatigue. The sling is so constructed that if all 18 wires in each of the 6 strands are broken, the inside wires have sufficient strength to support the loads given in the tables.

An Arc Welded Crane

The Cleveland Crane and Engineering Company of Wickliffe, Ohio, is building a new type of overhead traveling crane in which the I beam bridge girders, end trucks and trolley are arc welded. Each girder is reinforced throughout its entire length by angles arc welded to the standard I beam sections. The end trucks are built up of two standard channel sections joined by arc welding. Roller bearings are used to speed up acceleration and reduce power consumption. Gear guards, foot bridge hand rails, and bridge drive shaft bearing supports are also arc welded, all of the welding being done by machines furnished by the Lincoln Electric Company.

General Electric Company Elects Officers

The board of directors of the General Electric Company at a recent meeting elected three honorary vice-presidents, all of whom are directors of the company and will continue as such. They are: J. R. Lovejoy, vice-president, associated with the company for 42 years; George F. Morrison, vice-president, associated with the company for 45 years; and B. G. Tremaine, one of the organizers of the National Lamp Division.

F. W. Frech, manager of the incandescent lamp department, was elected vice-president of that department; Dr. W. R. Whitney, director of the research laboratory, was elected a vice-president and director of research.

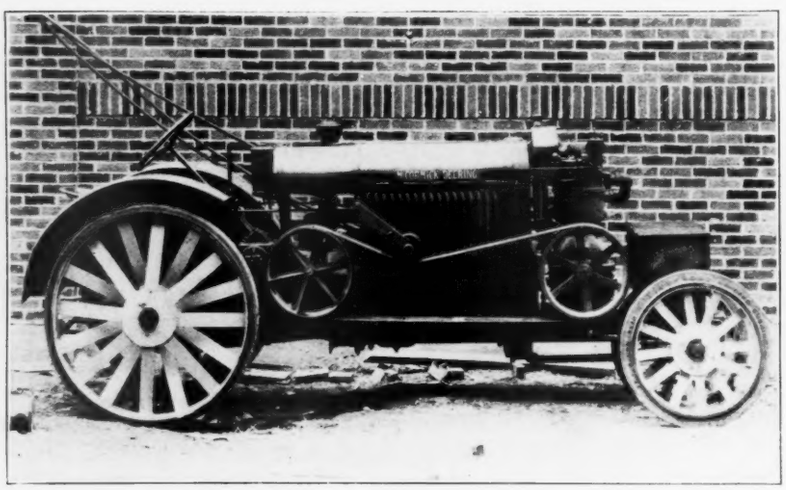
Recording Fuel Waste

It has been pointed out by the Uehling Instrument Company of Paterson, New Jersey, that the 35 per cent or more of the heat in fuel which is lost to the boiler may be prevented by Apex CO_2 recorders. Burnt out spots in the fuel beds, which are among the most persistent of fuel wastes, are readily detected by these recorders.

The design of these CO_2 instruments is based on more than 30 years experience. Workmanship is of the highest grade and all materials are of good quality, rigidly inspected and guaranteed. The recorder is simple of operation, easy to understand and has but few parts. Chemical solutions are not employed as the CO_2 is absorbed in a dry cartridge.

A New Agitator

The Hill Clutch Machine and Foundry Company of Cleveland, Ohio, has developed the new Hill Tubular agitator, which insures a positive and powerful current with a small expenditure of power. The current action gives a rolling movement of intimate mixing outside the tube and a return to the inside of the tube which completes the cycle. The entire mass is in constant movement and there are no dead spots where the liquid does not circulate.



Pontiac Portable Compressor

Self Propelling Compressor

The Pontiac Tractor Company, of Pontiac, Michigan, is manufacturing a Quincy Type W-4 self propelling four-wheel air compressor of 124 cubic inch displacement. A separate radiator with pump-driven circulation cools the compressor which also has a three-bearing crankshaft and force feed lubrication. The compressor with air tank and tool box are mounted on a frame which attaches to either the McCormick-Deering or Fordson tractors. Power from the tractor drives the compressor through the power take-off pulley, which has a clutch allowing it to be thrown in or out of gear.

International Harvester Holds Conference and Demonstration

International Harvester Company held a conference and field demonstration for manufacturers and distributors of McCormick Deering Industrial Tractors and equipment on July 25th and 26th in Chicago at the International Tractor Works. A splendid exhibit was arranged and the public were admitted on July 27th.

The conference was a splendid example of cooperation between manufacturers and distributors. A number of International executives were in constant attendance. Forty manufacturers using International units as part of their equipment were present and had equipment on display and in operation. Thirty distributors were represented by their sales and service organizations. A banquet for all in attendance was held on July 25th at the Stevens Hotel.

The Industrial Sales Organization of the International Harvester Company is to be commended for its work in planning and effecting the conference and demonstration. The enthusiastic comments from those present should influence future conferences.

Among the manufacturers represented by exhibits of interest to Pit and Quarry readers were American Chain Company, Baker Mfg. Company, Bay City Dredge Works, Blair Mfg. Company, Ersted Mfg. Company, Garst Mfg. Company, Hanson Cl. & Machy. Company, Hughes-Keenan Company, Kentucky Wagon Company, Miami Trailer & Scraper Company, Perry Company, Pontiac Tractor Company, Sauerman Bros., Inc., Schramm, Inc., Timken Roller Bearing Company, Trackson Company, Williamette Iron & Steel Company, and W. A. Riddell Company.

Oxweld Acetylene Describes

The Oxweld Acetylene Company, 30 East 42nd Street, New York City, is distributing a new catalogue describing the products manufactured by this concern. These include all kinds of welding, cutting, brazing, lead burning, heating and decarbonizing equipment and acetylene generators. New items described are the type C-14 cutting blowpipe, the Carbic low pressure portable acetylene generators and the Carbic floodlights.

L. B. Foster Company Opens St. Louis Office

The L. B. Foster Company recently opened an office in the Railway Exchange Building, St. Louis, Missouri, with C. D. Armstrong in charge. A large stock of relay rails and accessories are on hand in the company's yards in St. Louis.

Brookville Locomotives Described

The Brookville Locomotive Company, Brookville, Pennsylvania, is distributing a bulletin describing the Brookville gasoline locomotives. These locomotives are made in sizes weighing from 1½ to 6 tons, in gauges of 18 to 56½ inches. Locomotives over 6 tons in weight have gauges 22 to 56½ inches. They are powered by gasoline motors manufactured by the Ford Motor Company, Dodge Brothers, Incorporated, International Harvester Company, and other well known makers, insuring availability of service.

The spring type journal boxes and other features as well as the short wheel base allow these locomotives to negotiate short curves and uneven track. Axles are made of alloy steel. Wheels are either of the spoke or solid type and vary in design with the size of the locomotives. Both service and emergency brakes are supplied, the latter being effective on the power unit transmission countershaft. All bearings except those in the engine and power unit transmission are equipped with Alemite or Zerk grease fittings. Tables giving the estimated amount of material required for a mile of track when different weights of rail are used, approximate weights of industrial cars, and weights of various materials are included.

Garst Power Plow Scraper

The Garst Manufacturing Company of Chicago, Illinois, in Bulletin Number 1 describes the Garst power plow scraper for sand and gravel and general excavating work. A number of illustrations show this scraper being used on different types of work and a discussion of its advantages is included.

Foote Adds Hoyt

Mr. R. W. Hoyt, formerly of Alfred Gardner and Company, has recently joined the sales organization of Foote Bros. Gear & Machine Company. He will cover the territory on the south side of Chicago extending from Roosevelt Road south to 63rd Street.

New System for Burning Lime

Economy of labor and high efficiency are characteristics of a recent development in the lime industry known as the "Sobek System for Lime Burning." The system includes all the necessary equipment for the manufacture of lime, i.e., storage bunkers for fuel and stone, kiln, skip hoist for raising charge to top of kiln, charging apparatus for securing even distribution of the charge in the kiln, drawing mechanism which provides for continuous drawing of lime, screen for separating lumps from the fines and ashes, and conveyors for delivering burned lime to cars or storage. The blower or exhauster, depending on the kind of draft, and all piping and transmission machinery, exclusive of motor power, are also a part of the system. The heart of the system is the kiln, but the other features are almost as important and the inventor wisely specifies that they must be included if maximum efficiency is to be secured.

The Sobek System has several new features of design, chief of which are the arrangements for feeding the stone and fuel and discharging the lime from the kiln. Both these operations are continuous and are a radical departure from American practice. These charging and discharging mechanisms are covered by patents owned by Mr. Sobek. This continuous charging and drawing process is very similar to that of the rotary kiln but without the high operating expense and high radiation losses. The movement of the stone and fuel is constant, but much slower than that of a rotary kiln, thus allowing time for burning pieces of stone as large as are handled in an ordinary shaft kiln. Part of the air used for combustion is drawn through the discharging apparatus, permitting the lime to be drawn at low temperature and eliminating the cooler usually necessary with a rotary kiln.

The kiln is an upright steel shaft with fire brick lining similar to those used in the United States. The fuel and stone are fed into the top and the lime withdrawn at the bottom, just as is the practice here. The differences consist in the methods of feed, control and discharge. The feeding is accomplished by means of a skip hoist, in a manner similar to that used in blast furnace practice. The patented charging apparatus, however, secures a better distribution of the stone and fuel, than has been possible heretofore. This results in a more evenly burned product of uniform quality. Provision can be made for securing combustion by means of natural, induced or forced draft, with coal or coke as fuel. The Sobek system also provides for the use of lignite or other fuels of low calorific value, as well as for the use of producer gas. Practically perfect control of combustion is secured by the provision of access and peep hole doors at several levels. The discharging apparatus, also covered by patent, provides for continuous discharge of lime and is also furnished with a screening arrangement for separating the lumps from the fines and ashes.

Owing to the excellent results secured, Mr. Sobek has designated his kiln by the title "High Efficiency Lime Kiln." Using coke as fuel, the average fuel ratio has been found to be from 5½ to 6:1, which is certainly high enough to justify the above title. This name is also deserved by the small amount of attention required by the system. One man to operate the skip hoist, and another to supervise the burning and drawing, are all that are needed, whether the production be 25 tons or 100 tons per day. From this it may readily be seen that the operation of hoist, and the distribution of the fuel and stone in the kiln are entirely automatic, being accomplished by means of the patented charging apparatus referred to above. The same automatic operation is a feature of the discharging mechanism, occasional supervision and adjustment being all that is required.

That the manufacturers and users of lime burning equipment are awake to the possibilities of the Sobek System, is evidenced by the facts that the McGann Manufacturing Company, Inc., of York, Penna., have secured the American rights to build and market the equipment, and that Mr. Sobek has received several inquiries from various sections of the United States as to prices, etc., of his system. One of these inquiries was from the Allwood Lime Company of Manitowoc, Wisconsin, which company sent a representative to Austria to see the Sobek system in operation. He found all the claims made for it to be entirely justified by the results obtained, and it is extremely likely that the first Sobek kiln to be built in this country will be erected at their plant in the near future.

The Sobek kiln is at present made in four sizes, ranging from 10 to 16 feet in diameter, and from 60 to 90 feet in height. The smallest has a capacity of 20 tons of lime per day, while the largest has a capacity of 100 tons per day. The system is not limited to 100 tons as a maximum, this being merely the largest size built up to the present time.

Electronic Tornado Welding Method Described

The Lincoln Electric Company, of Cleveland, Ohio, has published an eight-page illustrated booklet entitled "Automatic Arc Welding by the Electronic Tornado Process." This method of welding differs in one important particular from ordinary carbon arc automatic welding. Instead of melting the plate edges so that the entire thickness directly under the electrode is molten, requiring water cooled fire strips on both sides to confine the molten metal, by this process the arc is adjusted so that the weld will penetrate slightly more than half way through the plate, obviating any necessity for a fire strip. The plate is then turned over to complete the weld. In the case of plates less than one-fourth inch thick, however, the weld is made in a single traverse of the plate, requiring a simple backing up strip on one side only.

A number of illustrations, drawings and descriptions of this method in actual use on different kinds of work are included, as well as a table giving the costs of welding butt joints, lap joints, and edge welds for different thicknesses of metal.

A New Reversing Switch For A. C. Motors

The General Electric Company has perfected a new motor control switch for reversing small alternating current motors where they can be thrown across the line. The switch has two triple pole, barrier type, magnetically operated contactors, mechanically and electrically interlocked, having double break contactors with silver contacts, operated by a high speed solenoid, which gives the switch a high interrupting capacity with minimum arcing. Two hand reset temperature overload relays are mounted on a molded base and are enclosed in a case. They protect the motor from overheating because of mechanical overload or single-phase operation, and are a fixed part of the switch, but have interchangeable heaters. The switch can be adpated for use with a motor of the same voltage but with a different rating by selecting heaters corresponding to the motor current.

Sunshine Quarries, Greene County, Mo. Capital $25,000. W. J. Johnston, S. C. Conway, H. B. Johnston, Mona F. Conway.

General Asphalt Corp., San Antonio, Tex. Capital $100,000. H. E. Wilcox, H. J. Wilson, D. A. Gregg.

Four New "Caterpillar" Books

A set of four books covering different phases of industry have just been published by the Caterpillar Traction Company, San Leandro, California, and Peoria, Illlinois. The titles are "'Caterpillar' Power for Public Utilities"; "'Caterpillar' Power for Factories"; "'Caterpillar' Power for Mines & Quarries"; "'Caterpillar' Power for Railroads, Warehouses and Docks." They are completely illustrated with action photographs gathered from "Caterpillar" jobs throughout the world. Write to the San Leandro, California, headquarters or call at your local dealer in "Caterpillars" for free copies.

"'Caterpillar' Power for Public Utilities" has 40 pages, divided into sections — Telephones, Gas, Water, Light and Power. Hauling over mountainous roads, stringing cables and salvaging old wires are some telephone jobs described. Filling ditches, laying pipe line, pulling pipe sections into place, excavating for gas plant, moving camp, and hauling are seen in the gas section. "Bigger than the weather," the old "Caterpillar" slogan, hits the reader in the striking pictures of mud, sand, ice and snow work required in public utility work.

The laying of 240 feet of electric cables under brick paving in six minutes time is pictured in the section on light. This involves use of a subsoiler. Moving pile drivers for the Southern California Edison Co., pulling cement forms for the Commonwealth Edison Co. in Chicago, clearing snow from Idaho roads for building transmission lines for the Washington Water Power Co. give an idea of the kind of work as well as the size of concerns using "Caterpillars." Scenes in Japan and Brazil where power and water developments are wrested from raw frontiers show how other sections of the world are following the latest developments in the United States construction methods.

Pictures from the Studebaker proving grounds, motion picture caravans on location on snow-covered mountains, steel factories, bulldozing in construction of a General Motors plant, pulling stumps to make Hercules gun-powder, leveling for railroad side tracks, lifting poles with cross arms for the Pennsylvania Edison Co.; hauling over mountains, deserts and streams regardless of weather; moving 7-ton sewer pipe conections, skidding big boxed export packages into cars from factory siding; glass factories, spool factories, foundries, brick plants, sugar factories, copper and brass factories; at drawbar, belt, power take off or winch, the "Caterpillar" does the world's hard jobs in scenes caught from the busy workaday world. The factory book tells the story.

"Scotty" Allan, all-Alaskan dog sweepstakes runner with French decorations for handling war dogs, is given a page in the book on "'Caterpillar' Power for Mines and Quarries." His 2-ton pulls sleds over the snowy trails of the Canadian Rockies to get supplies to the mine of the Cascade Consolidated Silver Mining Co., 22 miles from the railroad. Gold mining in Alaska, borax hauling in Nevada, quarry stripping in Pennsylvania, pulling scarifiers to dig out the clay for brick in Arkansas and Texas, stripping overburden from quarries in Wales, hauling a rock crusher in California, handling rock in Cuba and phosphate in Florida—"Caterpillars" are doing new jobs "Better, Quicker, Cheaper" every day in some corner of the world.

Southern Pacific, Santa Fe, New York Central, Pennsylvania, Illinois Central, Great Northern, Denver & Rio Grande, and T. P. & W. are some of the railroads on which "Caterpillars" are pictured or described in the book on railroads. The great $5,000,000 Southern Pacific freight yards job at Fresno, California, occupies the center two pages of the book. Here a record was made with 12 "Caterpillar" Sixtys in cutting the time one-fourth and the costs of dirt moving one-third. Flood scenes in which "Caterpillars" cleared tracks of debris and pulled smashed bridge piling following the break of the St. Francis dam last March are shown. Hauling dead locomotives, spotting freight cars, clearing snow from switch yards, stringing cables, excavating, filling, etc., show the versatility of the "Caterpillar" in railroad work.

Arc Welding Discussed

The General Electric Company is distributing two interesting bulletins on the subject of Arc Welding. The one is GEA-432A, "Art Welding in G. E. Factories," consists of 28 illustrated pages, and supersedes GEA-423, and the other is GEA-995, "Art Welding in Industry," which consists of 32 illustrated pages.

To those who are interested in arc welding, these bulletins will be of considerable value as they describe how arc welding has made possible large units and a more efficient application of mechanics. In industry, the speed and accuracy of arc welding are portrayed and how lost time has been reduced when a broken part occurs. Arc welding has been used to weld high pressure steam lines, build up lugs on pinions, weld crank shafts and many other useful performances.

L. R. Flexible Coupling

Foote Bros. Gear and Machine Company of Chicago, are manufacturing a practical coupling known as the L. R. coupling. The L. R. coupling is particularly desirable for use with small fractional horse power motors. Because of its flexibility and comparatively low cost it fills a long felt need among machine manufacturers and users of small motors.

The L. R. flexible coupling is substantially a jaw coupling with radially disposed loosely floating, resilient rollers, placed between jaws which extend from the flanges parallel with the shafts. This assures a rolling contact between them upon relative movement caused by either misalignment or end movement of the shaft of the power agency. The coupling may be used for rotation in either direction, half the rollers being under compression and the other half idlers.

Inasmuch as the force is transmitted by compression, and a relative movement of the shafts is accomplished by a rolling movement of the power transmitting elements, there will not only be absent any end thrust in the shafts but also any radical thrust. The life of the coupling is, therefore, practically unlimited and the coupled equipment rendered perfectly safe and shock proof.

The L. R. flexible coupling is best adapted for direct connecting small motors to the driven machine. Being inexpensive, sturdy and efficient, the L. R. coupling fits into the production schedule of the majority of small machinery manufacturers. Thousands of these couplings are being used by manufacturers of washing machines, refrigerators, oil burners, compressors, electric tools, and other similar industrial machines.

Constructed on a new, but simple principle, L. R. couplings stand up under the most severe tests. No parts to lubricate, as at no time does it receive undue stress or action. True alignment and adjusting of the shafting is not so necessary with the L. R. coupling. Even with an anguar misalignment up to 7½ degrees, lateral misalignment to 3/16 inches and end playup to ¾ inches, the L. R. coupling will function properly and with quiet efficiency.